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ANATOMICAL STUDY OF A SHORT-LIMBED DWARF, WITH SPECIAL REFERENCE TO OSTEOGENESIS IMPERFECTA AND CHONDRODYSTROPHIA FŒTALIS.[1]

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of Chicago.

In the winter of 1901 there fell into my hands the body of one Thomas Wilson, concerning whom the following facts are all that are known at this time: He could not walk very well and supported himself by selling lead-pencils and chewing-gum from a roller chair. He was a hard drinker. Two persons who knew him during life state that in their opinion he was of ordinary intelligence. It is unfortunate that nothing is known of his early life. He died January 5, 1901, in a so-called "bum lodging-house," at the supposed age of forty-five years. A post-mortem examination was made by the physician to the coroner's office, and rupture of the gall-bladder is mentioned in the certificate as the chief cause of death. The body was then kept in a refrigerator until March 7, 1901, when a second post-mortem was made, with the following result:

There is a sutured post-mortem incision from the top of the sternum to the pubes, and there is also a sutured incision in the left arm. The body is diminutive in size; the head and trunk are more nearly normal in size; the lower extremities are perceptibly shorter in proportion. In the lower extremities, especially the legs, the skin seems to be looser than usual; there is a moderate curvature of the spine in the thoracic region, the convexity extending forward and to the left, with a marked curve in a forward direction in the lumbar region. The bones of the extremities are the only ones that show any abnormalities on external examination. The long bones are the seat of various curvatures and nodular enlargements, especially at the articular ends. In the left humerus there is a distinct interruption of the continuity in the lower third, but this has not the appearance of a recent fracture, and crepita-

[1] The skull is described by Charles A. Parker, M.D., and the thyroid examined chemically by H. G. Wells, M.D.

tion is not obtained. (In the X-ray photographs of the body, kindly made by Dr. Smith, resident physician of the Presbyterian Hospital, the bones of the skeleton are seen to be excessively porotic, anomalous in form, the long bones being greatly swollen at the ends.) The right knee-joint is larger than the left, and there is a swelling in the head of the right tibia, which crackles on pressure. Incision into the joint shows a soft mass from which red hemorrhagic material can be scooped out. There are no evidences of decomposition, but there is considerable drying up of the tips of the fingers and toes, and of the nose, lips, and penis; the latter seems to be very small. The nose appears rather thin and sharp, and the root does not seem to be any more deeply inserted than is ordinarily the case. There is no distinct depression at the root. Two small testicles are felt in the scrotum. Otherwise the external examination reveals no further morbid lesions.

The following measurements were made:

Length of body	95	cm.
Estimated weight	75	lbs.
Length of right upper extremity	48	cm.
" left " "	49	"
" hands	15	"
Breadth of hands	6	"
Circumference of middle of right arm	30	"
" " " left "	30	"
Length of right lower extremity	37	"
" left " "	36	"
" feet	13	"
Breadth of "	7	"
Vertical diameter of patella	3	"
Circumference of right knee	28	"
" of left knee	24	"
" of middle of right thigh	27	"
" of middle of left thigh	25	"
" of head	30	"
Distance from tip of chin to highest point of head	27	"
" " root of nose to chin	11	"
" " glabella to occipital protuberance	21	"
" " " to protuberance over top of head	35	"
" between zygomatic arches	12	"
" from meatus to meatus over top of head	36	"
" between malars	11	"
" " angles of lower jaw	8.5	"
" from tip of chin to pubes	42	"
Length of spine (sacrum 7, lumbar 12, thoracic 18, cervical 11)	48	"
Circumference of neck	26	"
" at shoulders	69	"
" of chest at nipples	69	"
" of abdomen at navel	57	"
" of pelvis at level of superior spine	57	"

The body cavities are found filled with sawdust soaked in formalin. The heart, lungs, spleen, pancreas, liver, kidneys and lower urinary organs, testicles, and organs of the neck do not present any gross lesions recognizable at this time. All the organs are smaller than those of a normally developed, full-grown man. The heart weighs 145 grammes; the kidneys, 105 grammes; the spleen, 30 grammes; and the thyroid, which is symmetrical and flattened, 9 grammes.

The diameter of the aorta at its beginning is 9 millimetres; in the middle of the descending portion it is 1 centimetre.

FIG. 1.

Photograph of the body. Note relative shortness of the limbs.

The gall-bladder does not show any changes, but there is a tear across the centre of the free aspect.

The bones of the skull are rather thin and cut easily with the saw. The brain is quite soft, and the hypophysis weighs 0.65 grammes.

The skeleton was prepared for articulation and mounting.

HISTOLOGICAL EXAMINATION. *Heart.* There are no special changes. The number of nuclei in the muscle cells seems rather large. The striations are absent, the fibres are narrow, and branch and anastomose unusually freely.

Thyroid. In some parts of the gland there is no evidence of thyroid structure present—the gland here appears to have been entirely replaced by fibrous and muscular tissue. For the most part the typical follicular structure is replaced by fibrous tissue with oblong and variously-shaped spaces filled with rather small cells of various shapes, the nucleus staining diffusely, the cell body being without any distinct wall (Fig. 3), the nuclei are relatively large, the surrounding finely granular cytoplasm staining a light pink with eosin. In no place do these cells assume a distinct cuboidal form, and, as stated, there is no trace of any follicular arrangement. Small masses of homogeneous or finely granular colloid mate-

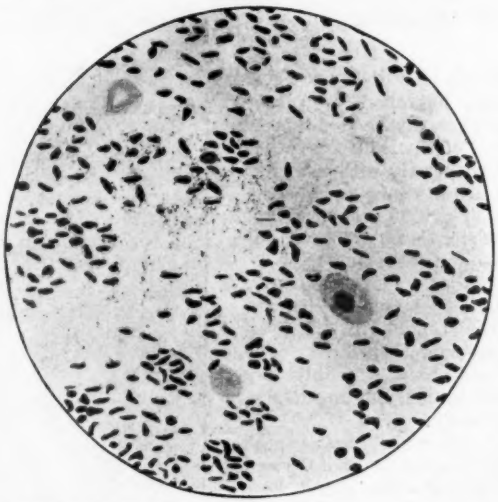
FIG. 2.

Photograph of the body.

rial occur here and there. Generally but one or two such masses appear in the field of a No. 3 objective. Sometimes colloid masses lie in spaces containing but few cells, the walls being formed by fibrous tissue. At other times the spaces are lined with endothelial cells. The thyroid contains a moderate number of bloodvessels of normal appearance; in some of the larger arteries at the margins there is fibrous proliferation in the intima and calcification of the elastica.

Hypophysis. The structure seems quite normal. There are small masses of colloid in a few of the follicles. There are no distinctly eosinophilic or cyanophilic cells present, the cell bodies generally assuming a light pink color in hæmatoxylin and eosin sections.

FIG. 3



Fibrosis and atrophy of the thyroid, with occasional colloid remnants.

Bones. Sections of bony tissue from various bones, especially the upper end of the right tibia, show an exceedingly spongy structure; for the most part only isolated fragments of bone occur, hardly any complete Haversian systems being present; there is no evidence of excessive lacunar absorption or halisteresis, but the number of bone corpuscles seems larger than usual. The marrow is fatty.

CHEMICAL EXAMINATION OF THE THYROID (by Dr. H. G. Wells). The thyroid gland, except such part as had been used for histological examination, was received in alcohol. In order to avoid possible loss from solution in the alcohol the fluid was evaporated to dryness in the incubator and the residue added to the gland substance, which was similarly dried. The weight of the substance combined was 0.766 grammes. Analysis was performed in the same manner as in the series previously studied, that is, by the modified Baumann's method. The residue from the infusion, after being evaporated, was shaken with 10 c.c. of chloroform, and no coloration whatever was imparted

to it. Therefore, if any iodine at all was present it was but a minute quantity, not over 0.05 milligramme. The average amount of iodine per gramme of dried thyroid in residents of Chicago has been found to be about 2 milligrammes.[1]

FIG. 4.

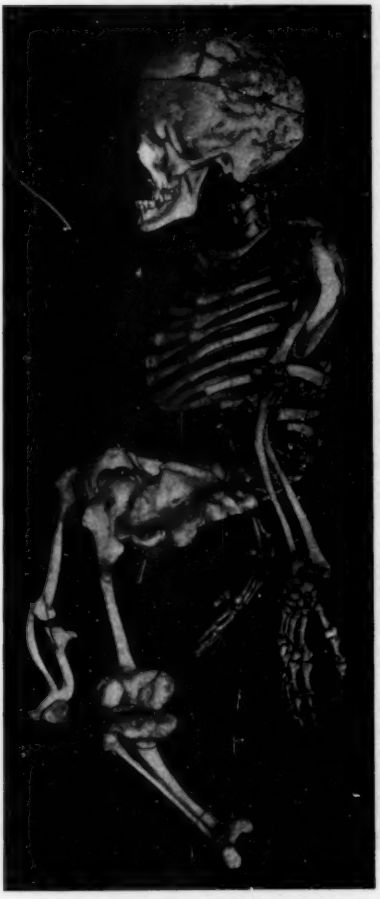
Photograph of skeleton. Relative length of upper extremities in this and in the two succeeding figures due to imperfect articulations, especially at the shoulder-joints.

EXAMINATION OF THE MOUNTED SKELETON (Figs. 4, 5, and 6). The skeleton as a whole is small and light, the total weight, including

[1] Concerning the method of analysis, see H. G. Wells, "The Physiology and Therapeutics of the Thyroid Gland and its Congeners." Journal of the American Medical Association, October 30, and November 6 and 13, 1897.

an iron rod to hold the spine together and copper wires at the majority of the joints, being only 1817 grammes. The bones in general are light and spongy; there is no sclerosis anywhere, the external as well as the internal architecture presenting many and striking variations

FIG. 5.



Photograph of skeleton. Left lateral view.

FIG. 6.

Photograph of skeleton. Right lateral view.

from the normal. The usual normal anatomical markings are greatly disturbed, often absent or not recognizable. In the following description only the essential and most remarkable departures from the normal type are mentioned briefly. The spine contains the usual

number of vertebræ. There is a slight curvature forward and to the left in the upper thoracic region, resulting in some elevation of the left shoulder. At the junction between the eleventh and twelfth thoracic vertebræ occurs a sharp bend forward almost to a right angle. The bodies of the twelfth thoracic and of the first lumbar vertebræ are much flattened, being 1 cm. in thickness in front. At the lumbosacral junction the sacrum bends backward nearly to right angles, but the lower end of the sacrum is bent forward at an acute angle, the coccyx projecting between the ischia.

The shoulder-blades are small and thin, and of a distinct fœtal character. In the right subscapular fossa is a defect 2 cm. in diameter, with smooth but thin margins. There are no distinct glenoid cavities, the enlarged heads of the humeri being partially received into a concavity formed by the elongated coracoid processes, which make a semicircle, and parts of the margins of which seem to form articular surfaces.

The normal curves of the clavicles are exaggerated. The right clavicle is 10 cm. long, the left 11.5 cm.

There is a slight thickening at the costo-chondral junctions. The heads and necks of the first five right ribs are more or less absorbed and amalgamated with the corresponding vertebræ by osseous tissue. The third, fourth, and fifth are broken at or near the angles; in the case of the third and fourth there seems to be false joints at the sites of the fractures; in the case of the fifth the fracture may be post-mortem. The vertebral ends of the first and second ribs are embedded in a rather irregular bony growth. There is an old ununited fracture, with smooth surfaces in the sixth right rib, about 6 cm. from the costo-transverse junction; another in the sixth left rib, about 3 cm. from the spine.

The humeri are misshapen, enlarged at the ends, and in the case of the right humerus, which is bent almost to a semicircle, the shaft is quite thick. The heads of the humeri are swollen into irregularly globular masses, 4.5 cm. in diameter, and composed of crumbling, spongy bone. At the junction of the lower and middle third there is a break in the left humerus; the ends are somewhat swollen and irregular; the opposing surfaces are fairly smooth; for some distance on each side the bone is thin and slender. The right humerus is 17 cm. long, the left 16 cm.

The bones of the forearm are more or less curved, especially those of the right forearm, but there is no marked enlargement of the articular ends. At the junction of the middle and lower third of the right radius is a fusiform swelling such as might be caused by the healing of fracture. The right ulna is 17.5 cm. long; the left 19 cm.; the right radius 17 cm.; the left 19.5 cm.

The bones of the carpi, the metacarpal bones, and the phalanges seem normal in shape and size.

The pelvis presents marked deformities (see Figs. 4, 5, and 6). The bones are thin, light, and fragile. The alæ, especially in the regions of the fossæ iliacæ, are quite like parchment, and there are two oval defects with thin but smooth margins in the left and one in the right, from 1 cm. to 1.5 cm. in diameter. At each acetabulum the bone seems to have been pushed toward the sacro-iliac articulation, so that the distance between the corpus ossis-ischii and the sacrum on the left side is less than 1 cm., and on the right side about 2 cm. There is no

distinct acetabular rim. The superior-posterior parts of the acetabular rims have large facets for articulation, with reciprocal surfaces on the anterior portion of the superior surfaces of the necks of the femurs. The foramina obturata face each other, the incisuræ acetabuli being very large, 3.5 cm. and 4 cm. in diameter. The pelvis is of an irregular hour-glass form. Diameters: At inlet—transverse, 10 cm.; antero-posterior, 4 cm.; oblique, 8 cm. Of cavity—transverse, 2.5 cm.; antero-posterior, 9 cm. At outlet—transverse, 6 cm.; antero-posterior, 6 cm.

The femurs are similar in general outline, both describing a large curve with the convexities toward each other. The lower ends are greatly expanded and contain large spaces; the lower end of the right femur has crumbled away considerably. The neck is short, relatively thick, the head large, exceedingly spongy. The right femur is 19 cm. long, the left 20.5 cm.

In the dry condition the left tibia and fibula measure 17 cm. in length. The ends are swollen, especially the upper end of the tibia, which is expanded more or less mushroom-like. Both bones are curved, the convexity being directed in the front. The upper ends of the right tibia and fibula have crumbled away. These bones are also curved extensively, and 3 cm. above the ankle the fibula is united to the tibia by a flattened bridge 1 cm. wide.

The bones of the feet are exceedingly light, consisting of a very thin compact layer, externally and interiorly, of larger and smaller cavities separated by walls of extreme thickness. Many of the smaller bones crumbled down, and it was not possible to articulate the feet.

The Skull (Dr. Charles A. Parker). The skull[1] presents on lateral view an unusually high cranium overtowering a small receding face and protruding lower jaw. In front it has a narrow oval outline with high orbits and irregular teeth.

The maximum length is 17.2 cm., the maximum breadth 13.2 cm., with a corresponding circumference of 49.5 cm. The height from the basion, or anterior margin of the foramen magnum to the bregma, inside measurement, is 15 cm. Although a comparison of these figures with those averaged from ten normal skulls shows both the breadth and length to be slightly over 1 cm. short of the average, yet the height, which is increased by 2 cm. (the compensation relation), completely compensates for the circumferential contraction, as shown by the capacity of 1450 c.c., that of the average normal male skull.

The cephalic index is 76.7, hence the skull is of the meso-cephalic type.

The internal surface of the base presents little variation from the average skull in form or measurements; the foramen magnum is normal in size, shape, and location, as are also neighboring parts of the occipital bone, except the upper part of the tabular portion, which is composed of Wormian bones.

The thickness varies from 2 mm. laterally, in the temporal region, to 9 mm., in the frontal and occipital the average being 4 to 5 mm. The distance from the basion to the foramen cæcum is 1 cm. above the average, which, considering the shortness of the skull and normal

[1] Further consideration of the skull will be given by Dr. Parker in a separate article concerning Wormian bones.

location of the basion, appears disproportionate, but is explained by the absence of the frontal sinus and crest. The foramen is situated 1 to 2 cm. nearer the anterior surface of the skull and correspondingly farther from the basion. It is not unusual to find the distance from the glabella to the foramen over 2 cm., while in this skull it is less than 1 cm.

The distance from the basion to the occipito-sphenoidal synchondrosis is normal, as is also the distance from the latter to the anterior superior angle of the sphenoid at the cribriform suture. The cerebral surface of the presphenoid measures 2.5 cm., while the postsphenoid measures but 2 cm., giving an index of 125 obtained by dividing 100 times the former by the latter, the angle being very close to 100 or both parts equal. In a series of skulls examined the maximum was 113 and the minimum 87.

FIG. 7.

Photograph showing Wormian bones of cranial vault.

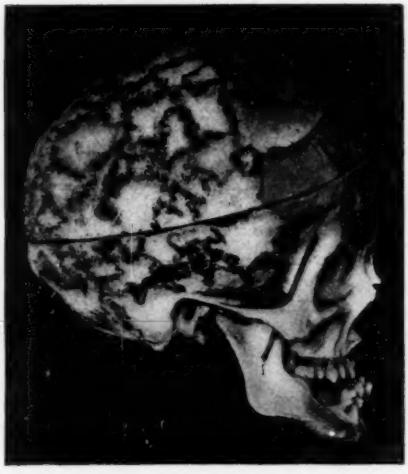
While the total length of the cerebral surface of the sphenoid is not affected, the disproportion between the two portions is unusual and constitutes the only noteworthy variation from the ordinary measurements of this region. Although somewhat asymmetrical in general outline, the entire cranium presents but slight variations from the normal measurements, the moderate circumferential constriction being accompanied by vertical elongation, with undiminished capacity, and the disproportion between the presphenoid and postsphenoid making no difference in the length of the floor.

The peculiar shape of the skull, with the recession of the face, may be represented by superimposing an outline of a median section of the skull upon a similar outline of an average normal skull, so that a line from the basion to the spheno-cribriform junction, the basal line of Huxley, is one exactly corresponding with a similar line in the other, their uppermost ends being at the same point (see Figs. 4 and 7).

Wormian Bones. The most striking feature of the skull is the extraordinary development and distribution of Wormian bones, numbering 172 (Figs. 7 and 8). They are most numerous in the posterior and lateral regions of the skull, supplanting the parietals, the squamous portions of the temporals, and the upper half of the tabular portion of the occipital. They are generally stellate in form, their numerous interlacing processes presenting an extensive pattern of delicate inlaid work. Several occur in the vertical and orbital portions of the frontal bones.

The inner surface is smooth, showing only the larger dentations, the finer process being limited principally to the outer layer. The parts free from them are the lower portion of the tabular plate, the condylar and basilar portions of the occipital, the mastoid and petrous portions of the temporals, the sphenoid and ethmoid bones, or those bones primarily developed in cartilage, the chondro-cranium.

FIG. 8.



Photograph showing Wormian bones of cranial vault.]

The sagittal suture is distinct throughout, and extends from the nasion to the chondro skeleton of the squamo-occipitalis, separating the parietal bones and dividing the frontal and membranous skeleton of the squamo-occipitalis into lateral halves. The coronal suture is well marked and sharply limits the forward extension of the Wormian bones, though one in the vertical portion of the right frontal bone and some in its orbital plate are in front of it. The lambdoid and squamous sutures cannot be traced. The sutures at the base show no special variations.

The frontal bone, which is divided into two parts by the persistent sagittal suture (metopic), presents a very high vertical portion and small orbital plates. In the upper part of the right half, bordering on the coronal and sagittal sutures, is a large quadrilateral Wormian

bone measuring 5 cm. by 9 cm., separated from the rest of the bone by a horizontal suture. Twelve small Wormian bones are located in the suture between the orbital plates and the alæ parvæ of the sphenoid, the cribriform plate and lateral masses of the ethmoid, the lacrymal, and the nasal processes of the superior maxillary bones.

Three-fourths of each parietal bone are represented by various forms of Wormian bones, varying in diameter from 3 mm. to 3 cm., while the remaining fourth consists of a single quadrilateral segment measuring 4 cm. by 8 cm., occupying the anterior superior angle. Bordering the coronal suture on either side below the larger segments are three or four of smaller size, ranging from 2 cm. to 3 cm. in diameter. The temporal ridges are indistinct or absent. On the inner surface the grooves for the meningeal arteries are well marked. The average thickness is 3 mm. to 4 mm.

The squamous portions of the temporals, together with the lower borders of the parietals, from which they are indistinguishable, present the most delicate tracing, in many bones the long interlacing processes being limited entirely to the outer layer.

The upper part of the squamo-occipitalis is formed entirely of Wormian bones.

The distribution by numbers in the different regions may approximately be given as follows: frontal bone, 12; parietals, each 40; temporals, each 25; occipital, 30.

Although so much of the cranium is composed of Wormian bones, yet the cranial anlage are well preserved, the principal sutures and bony areas being present and in their proper relations, showing that whatever general influences affected the skeleton, they were, in the skull at any rate, limited to osteogenesis and not of earlier origin or farther reaching in their effects disturbing the fundamental elements and interfering with the type of development as is observed in the perverted chondrogenesis of chondrodystrophia fœtalis and frequently seen in monsters.

The same may be said of the rest of the skull; all the bones are present with their usual relations, though the imperfect development of some produces considerable deformity, most marked in the recession of the face.

Recession of the Face. When considered with the fact that the second and third molars, and the left lateral incisors in the upper jaw, and the left third molar and lateral incisor in the lower jaw have never erupted, it is evident that the marked recession of the face, reaching its maximum at the teeth, is due to perversions in the evolution of the latter, with consequent pernicious effects on the development of the jaws, which, together with the bones resting upon them, give the face its outlines.

The great disproportion between the height and width of the posterior nares, the latter exceeding the former by fully 1 cm., gives a broadening effect which, with the incomplete dentition already noticed, stamps the face anatomically of the infantile type, the general deformity being particularly conspicuous because of the adult cranium.

In discussing the nature of the fundamental process which led to the remarkable hypoplasia and deformity of this skeleton, at least four distinct conditions must be considered, namely, rickets, cretinism, chondrodystrophia fœtalis, and osteogenesis imperfecta.

The studies of Stilling,[1] Hildebrandt,[2] and Harbitz[3] show very clearly that the disease called by Vrolik and by Stilling osteogenesis imperfecta, which previously in all probability was classed under fœtal rickets, is a definite, intrauterine process, the chief characteristics of which are great brittleness and softness of the bones, numerous fractures, and resulting deformities, due to as yet obscure disturbances of myelogenic and periosteal bone formation. The histological studies show that typical lamellar bone tissue and large trabeculæ are not formed.

"The trabeculæ are small, few in number, far removed from one another, and more or less irregularly arranged; in part they are without mutual connection. A continuous system of trabeculæ with lamellar arrangement, Haversian canals, etc., is absent." (Harbitz.) The number of cases is as yet small, and the observations seem to be limited entirely to the bodies of newly-born and very young children. The possibility of recovery from the disease has not been discussed to any extent, and the condition of the skeleton in the event of recovery and continued life cannot be determined from the facts at hand. It is noteworthy, however, that the disease is not necessarily fatal, because Hecker,[4] Bury,[5] Klem,[6] and Railton[7] have described cases two years, eight months, and one year old, respectively; and Harbitz is inclined to the belief that some of the instances of dwarfism previously referred to fœtal rickets, and now regarded as examples of chondrodystrophy, may have been cases of osteogenesis imperfecta. Gurlt[8] has noted that osteopsathyrosis (fragilitas ossium) occasionally seems to depend upon hereditary conditions, but its possible relation to osteogenesis imperfecta awaits future study.

The condition of the cranium in osteogenesis imperfecta is an interesting one. Vrolik,[9] J. Schmidt,[10] and Harbitz found that in their cases the calvaria consisted not of continuous bone, but of a mosaic of larger and smaller bone plates, which sometimes touched one another, at other times were united by bridges of periosteum and dura. In Stilling's case the cranium consisted of a membranous sac, with occasional bone spicules here and there. The great number of Wormian bones in the skull of the skeleton now described might well be attributed to such disturbances of cranial ossification. So far as the observations go there seems to be no disturbance at the basal synchondroses in osteogenesis imperfecta.

In the present case the condition of the cranium, the fractures (ribs, humerus), and the evident deficiency of periosteal and myelogenic

[1] Virchow's Archiv, 1899, cxv. pp. 357–370.
[2] Ibid., 1899, clviii. 426–444.
[3] Zeigler's Beiträge, 1901, xxx. pp. 605–628.
[4] Case abstracted by Harbitz, loc. cit., p. 611.
[5] Ibid.
[6] Ibid.
[7] Ibid.
[8] Handbuch der Lehre von den Knochenbruchen, 1862, I. Theil, p. 147.
[9] Cited by Stilling.
[10] Cited by Harbitz.

ossification in general, favor the notion that it concerns an instance of osteogenesis imperfecta surviving far into adult life. There is, however, relatively only little evidence of previous fractures in the bones of the skeleton. The old fractures in some of the ribs may have been the result of ordinary traumatisms. The number of fractures generally present in the cases described in the literature is usually so large that definite traces would be expected to persist should the patient survive. Virtually all cases of osteogenesis imperfecta so far described have died under one year of age, and it is not impossible that in survivors the traces of healed fractures and infractions eventually may be obliterated or represented by various thickenings.

Harbitz[1] mentions a dissertation by Ekman[2] that contains a detailed description of a family characterized by the occurrence of dwarfism and osseous fragility through three generations. The ancestor could not walk because of deformity; of his four children, one daughter was small and deformed, with curved arms and legs, and one son was a dwarf. This son had, with a healthy wife, a son that from earliest childhood was liable to fractures on the slightest provocation. He also had curved extremities. This man married a healthy wife and had two children, first a son, who had so many fractures during his youth that when full grown he could not move, and second a daughter, who likewise suffered multiple fractures from early childhood and always remained dwarfed.

While the general appearances of the body in this case may remind one at first glance of a cretin, especially because of the general dwarfing, there is absent the facial expression, the depressed nose, and the thick lips of cretinism, which probably may be ruled out because of the fair degree of intelligence apparently possessed by the individual during life. There is no myxœdema, and the dwarfing is not wholly symmetrical. The total or almost total absence of thyroidin would favor cretinism, of course, as does the practically complete obliteration of the normal structure of the thyroid.

It is difficult, perhaps wholly impossible, to determine the exact influence which the abnormal state of the thyroid may have exercised upon the man's general health and upon the process of osteogenesis, because of the lack of definite knowledge in regard to his past history and the absence of the evidence that might have resulted from the use of thyroiodin early in life. Perhaps the evil effects of the fibroid transformation of the thyroid were wholly alleviated by compensatory activity on the part of the hypophysis, the weight of which is considerably above the normal average and the structure of which seems fairly normal. The apparently intimate relations between growth of the

[1] Loc. cit.

[2] Dissertatio medica descriptionem et casus aliquot osteomalaciæ sistens. Upsaliæ, 1788.

skeleton and the physiological functions of the thyroid should stimulate to careful chemical and histological study of the thyroid in all instances of general disturbances of skeletal development. In chondrodystrophia fœtalis we lack information as to the chemistry of the thyroid, which often has been found abnormal in its appearances. In Harbitz's case of osteogenesis imperfecta (fœtus within four to five weeks of full term) the thyroid and thymus did not contain any iodine, but stress cannot be laid on that fact because iodine may be absent normally in the newborn.

The skeleton shows some features that might be explainable on the basis of a healed, severe rickets, such as the beaded ribs, the curvatures, and the flattening of the long bones, the spinal and pelvic deformities. The unusually large number of Wormian bones point to intrauterine disturbances of ossification in the cranial vault. In this case an attempt to trace the condition of the skull to rickets would place the disease at a very early period of intrauterine development, namely, at the sixth to the eighth week, and there seems to be little to warrant such an assumption. The occurrence of congenital rickets, meaning by that rickets which has run its full course before birth, is denied by most observers. As rickets heals the bones become abnormally dense and plump—exactly the reverse of the condition of this skeleton, in which there is also marked enlargements of the articular ends of the long bones. There is absence also of the peculiar deformities (pectus carinatum, funnel-shaped breast) of the thoracic cage, an absence the more significant in view of the profound changes in other parts of the skeleton. True rickety dwarfs usually present long arms, femoral and tibial curvatures. In this case the micromelia is rhizomelic. For these reasons I am inclined to believe that rickets in the ordinary sense cannot explain the case.

Osteomalacia hardly needs to be discussed extensively. As this disease subsides the affected parts may become more or less sclerotic. The shortness of the long bones and the condition of the skull are not explainable on the score of osteomalacia as generally understood.

A glance at the photographs shows that the man was not a true dwarf (microsomia), but a short-limbed or micromelic dwarf. The first general impression probably would be that it concerns an instance of chondrodystrophia fœtalis of Kaufmann or achondroplasia (Parrot). This disease, concerning which much has been written of late,[1] was formerly classed as fœtal rickets, which term even now is sometimes used expressing the same thing as chondrodystrophia. It is thought to have existed in ancient times, because the statues of the Egyptian god

[1] A fairly good review of the literature is given by Klein in Centralbl. f. allg. Path. u. Path. Anat., 1901, xii. 833–849.

Phtah and other deities are good representations of the external appearances produced by this disease.[1] Chondrodystrophia fœtalis affects especially the bones which arise in the cartilage in early fœtal life. Indeed, it is said to run its course between the third and sixth weeks, so that it would be stationary or cured when the child is born, while its effect upon the skeleton would remain permanent. The bones especially affected would be, then, those at the base of the skull, the ribs, the pelvis, and the long bones of the extremities. The bones formed entirely in the membrane, and those which, though formed in the cartilage, remain altogether or mainly cartilaginous until a late period of intrauterine life, are usually quite normal in size. Certain changes in the bones of the hands, especially the fingers, described by John Thomson,[2] William Turner,[3] and others, would seem to indicate that the disturbances of ossification may go on at a little later period. The lesions are usually symmetric, the micromelia is rhizomelic; there is some macrocephaly, "trident hands," and normal thorax.

The cause of the disease is wholly unknown. Perhaps B. Morpurgo's[4] observations on malacic and rickety changes in the skeletons of young white rats, produced by the injection of the cultures of a diplococcus, may prove of value in seeking for explanations of the osseous lesions in rickets, chondrodystrophy, and other diseases. In Morpurgo's animals the lesions at the epiphyseal zones of ossification were similar to those seen in rickets. Regnault[5] claims that "chien basset" (basset hound) depends upon a disease that corresponds to chondrodystrophia or achondroplasia (Parrot), as the condition is termed in the French literature, in which it also seems to cover osteogenesis imperfecta of the Germans. The peculiar race of dogs referred to has resulted, he says, from the fixation by heredity of an anomaly by means of artificial selection. Leblanc[6] and Apert[7] also believe that achondroplasia occurs in animals. "Maitons aneons" (descendants of certain sheep in Massachusetts), "bœufs notos," "veaux-bouledogues," "veaux-tortues," and "chien basset" are the examples given. But in no case has this claim been substantiated by careful histological study. And Cestan points out that here it concerns veritable races capable of transmitting the peculiarities to descendants, whereas achondroplasia in man occurs usually in isolated cases, which rarely transmit the disease, the children, if any are born, being usually normal. History records that the efforts of

[1] Harbitz, loc. cit., note on page 637. Charcot and Richer: Des difformes et les malades dans l'ast, Paris, 1889, p. 12.
[2] Edinburgh Medical Journal, 1892-93, vol. xxxviii. pp. 1109-1113.
[3] Practitioner, 1899, vol. lxiii. pp. 263-277.
[4] Centralbl. f. Path., 1902, xiii. p. 113.
[5] Bull. et Mem. de Soc. anat. de Paris, 1901, lxxvi. pp. 386-389.
[6] Compt. rend. de Soc. de Biol., 1902, liv. 88, 89.
[7] Ibid., 127-129, and Nouvelle Iconographie de la Salpêtrière, 1901, xiv. 290-298.

Catherine de Medici and others to breed dwarfs did not succeed. Pourak[1] and others, however, have described an instance of apparent transmission of achondroplasia from parent to offspring.

Leblanc[2] claims that chondrodystrophy often is associated with myxœdema, and that the thyroid probably is the seat of primary disturbance. Nasan[3] also ascribes achondroplasia to thyroid dystrophy. This claim is not borne out by the observations of Cestan,[4] who, in a richly illustrated article, describes a case of chondrodystrophy in a girl, aged nine and one-half years, in which thyroid treatment was given a thorough trial for nine months but without effect, and Marie,[5] who, in two instances, failed to obtain any benefit from thyroid extract. Christopher[6] also failed to secure any effect with thyroiodin in one case, and Legny and Regnault[7] found the thyroid normal in three chondrodystrophic fœtuses. And then there is the fact that the lesions of chondrodystrophy develop in the earliest months of fœtal life before the thyroid is fully developed.

The histological changes which have been studied thoroughly by Kaufmann[8] and others vary more or less according to the form or variety present, of which Kaufmann recognizes three, namely, the malacic, the hypoplastic, and the hyperplastic. Of the latter only three or four cases are described.[9] Whether chondrodystrophia malacica, hypoplastic, and hyperplastic are all expressions of the same fundamental disturbance or process may well be doubted. As indicated by the terms used the epiphyseal and other cartilages may be the seat of defective development, of softening, or of overgrowth, the latter being irregular; in all cases normal ossification and growth in length fail to take place, as no columns of cells are formed as normally. Ingrowth of the periosteum at the lines of ossification may occur, and this may also prevent growth in length.[10] The shafts of the long bones increase in growth from periosteal ossification, which goes on normally in this disease, and the bones become more or less irregular, and, as a rule, thick and plump, hard and sclerotic, as well shown in radiographs, the internal architecture being abnormal. Deformities may arise. Premature synostosis at the base of the skull, and a more or less depressed insertion of the nose, may result.

Two types of physiognomy are spoken of, the cretinoid (premature

[1] Cited from Nouv. Arch. d'Obst. et de Gyn., 1889-90, by Thomson, loc. cit.
[2] Loc. cit.
[3] Rev. de Neurologie, 1901, p. 549.
[4] Nouvelle Iconographie de la Salpêtrière, 1901, xiv. 277-289.
[5] Presse Medical, July, 1900, vol. iv.
[6] American Medicine, June 7, 1902.
[7] Compt. rend. de Soc. de Biol., 1902, liv. 567-568.
[8] Sogenannte Fœtale Rickets (Chondrodystrophia Fœtalis), Berlin, 1892; Zeigler's Beiträge, 1893, xiii. 32-64.
[9] Kaufmann, Johannesen, Klinger, Joachimsthal.
[10] Collmann. Virchow's Archiv, 1901, clxvii. pp. 1-13.

synostosis of the "os tribasilare"), and one marked by flattening of the whole nose rather than retraction of the root of the nose. In Johannesen's case there was no premature basal synostosis.[1] And Regnault also found the cranium normal.[2] The bones of the calvaria have been found generally normal (Harbitz), or there has been present an exquisite craniotabes (Klein). There may be more or less beading at the costo-chondral junctions. While the trunk is more nearly of the normal length, the extremities are too short, and the skin and soft parts here seem too large. In the hyperplastic form the epiphyseal ends are irregularly swollen. The pelvis is small and deformed, the cotyloid and glenoid cavities may be aplastic, and lordosis seems to be marked; it is explained as due to statical reasons, the weakness of the femurs throwing the weight of the body in front of the normal line. Regnault,[3] in a chondrodystrophic fœtus, found the vertebræ involved. Because the infants affected with this strange disease usually die before or shortly after birth (of Kaufmann's thirteen cases only three were born alive), not so very much has been learned as yet concerning the condition of the bones in those that survive. John Thomson[4] has described two living cases, aged thirty-nine and thirty-six years, the photographs of which in their general features are not unlike the appearances in this case, the noses, however, being much more depressed. The palates were high and arched. There were kyphosis and lumbo-sacral lordosis, and the limbs were half as long as they should be. The hands had a characteristic spade-like form, being broad and short, the fingers far apart, fusiform and thick, the index and middle fingers turning toward the radial side, the ring and little fingers to the ulnar ("main en trident"). This condition of the hands was absent in this case. Parrot[5] reports a girl, aged seven and one-half years; William Turner one aged ten years; Boeckh mentions a chondrodystrophic woman whose father and several relatives were similarly affected, and Pourak describes a micromelic female dwarf who became pregnant twice, one of the children showing the same condition as the mother. The disease is probably more frequent than the scanty reports in the literature may be regarded as indicating. The number of cases described has multiplied rapidly of late, especially in French and also in American literature. There is Baldwin's case, to which reference will be made shortly. Osler[6] describes two cases in brother, aged eleven and a half years, and sister, aged sixteen years. John Lovett Morse reported to the American Pediatric Society at its last meeting (1902)[7] an in-

[1] Reference cited by Klein, loc. cit.
[2] Bull et Mem. de Soc. Anat. de Paris, 1901, lxxvi. pp. 419–421, 424–426, and 597–599.
[3] Bull et Mem. de la Soc. d'Anat., 1901, lxxvi. pp. 559–560.
[4] Loc. cit.
[5] Loc. cit.
[6] Trans. Congr. Am. Phys. and Surg., 1897, vol. iv. pp. 190–192.
[7] American Medicine, June 7, 1902.

stance in a child that died at four months. In the discussion Griffith mentioned two cases, Holt one case, and Christopher one case. Abt[1] has described a typical instance in a boy of twelve years, under the title of "Ricketts." This case is interesting, also, because the coccyx was directed forward so as to cause pain on sitting. Cestan,[2] Apert,[3] and others also describe and illustrate living cases. In Cestan's case the micromelia was rhizomelic, the humerus and femurs being most affected. Apert notes that one not seldom sees cases in the streets. Undoubtedly many follow circuses and theatrical troupes. I have seen three apparently typical cases—two men and one woman—on the streets in Chicago, but I was unable to obtain any facts in regard to their history and exact condition. I also know a farmer in Wisconsin who is a micromelic dwarf, four feet and eleven inches in height, and 145 pounds in weight. The fingers of the left hand show the characteristic trident deformity, the fingers on both hands being more nearly the same length than normally and broad. The relative shortness of the limbs is especially marked in the lower extremities. He wears a No. 7½ hat, and the head appears large, the nose being well developed. He is a good worker and presents an athletic appearance, and is a man of intelligence. He was born of healthy parents of usual size; there is no other dwarf in the family. The appearance of chondrodystrophic adolescents and adults are so characteristic that, as Marie[4] says, if one does not recognize achondroplasia it is because he does not know the disease.

J. P. Baldwin,[5] in 1890, reported a successful Porro-Cæsarean operation upon a typically rachitic dwarf, weighing 100 pounds, and 47½ inches tall. The illustration accompanying the report shows well the characteristics of chondrodystrophy. The child is stated to have inherited the peculiar deformity of the mother, but no details are given.

Joachimsthal[6] used the X-ray in the study of dwarfism and allied conditions. In an instance of hyperplastic chondrodystrophy in a girl, aged twelve years, the epiphyses were cartilaginous and swollen, and there were certain peculiar appearances at the ends of the shafts due to the ingrowth of the periosteum, he thought. There was in Joachimsthal's case no growth in length in fifteen months. It is noteworthy that almost without exception those who survived beyond infancy are said to have been of average or more than average intelligence. Many are vigorous physically.

Virchow[7] has touched upon the conditions here discussed at various

[1] Archives of Pediatrics (reprint). [2] Loc. cit. [3] Loc. cit.

[4] Presse Medicale, July 14, 1900, where he gives an excellent description of chondrodystrophy in adults.

[5] Medical News, 1890, vol. lvii. pp. 138–141.

[6] Deut. med. Wochenschr., 1899, xxv. pp. 269–271 and 288–290.

[7] Virchow's Archiv, 1901, clvi. pp. 192–193; Ibid., 1883, xciv. p. 183.

times. He objects[1] to the term dystrophia, introduced by Kaufmann, because the condition imperceptibly shades into a pronounced developmental anomaly (missbildung), which, in its most characteristic form, is represented by phokomelia (Saint Hilaire, 1836). It concerns rather a profound disturbance in the formation of parts affecting not only cartilage, but also soft parts and bone. (Whether the smallness of the internal organs in cases like the one now reported is due to fundamental genetic disturbances or is secondary to skeletal hypoplasia cannot be determined off hand, and the question merits study.) Congenital rickets leads step by step to phokomelia. The name suggested by Kaufmann, and so generally adopted by others, puts into the foreground a single local disease which in turn is referred to a nutritive disorder. He is inclined to think that the name "fœtal rickets" may yet survive chondrodystrophy. As long ago as 1853 Virchow discussed the question of fœtal rickets upon the basis of a specimen in the museum at Wurzburg.[2]

SUMMARY. In the foregoing is described a fairly symmetric micromelic dwarf, aged forty-five years, presumably of fair intelligence; with a fibroid thyroid without any demonstrable thyroiodin; with a relatively large cranial vault made up of 172 Wormian bones, but without any evidence of premature ossification of the synchondroses at the base of the skull; with marked curvatures of the spinal column; with old fractures of many of the ribs and of the left humerus; with great deformity of the pelvis; with curvatures of most of the long bones, which are relatively short, the articular ends being swollen into irregular globular masses; with a general and pronounced osteoporosis; and with absence of trident fingers.

Cretinism or rickets or osteomalacia in all probability is not wholly responsible for the changes present in the skeleton. Taking all the facts and conditions into consideration, it must be acknowledged that the case presents some features best explainable on the score of osteogenesis imperfecta, others best explainable on the score of chondrodystrophia fœtalis, but as for reaching definite conclusion, it is unfortunate that the picture of either of these two diseases, as now understood, is incomplete in some essential particular; and, furthermore, that nothing is known of the man's earlier history. There is absent the premature synostosis of the cranial base of chondrodystrophia, and the bones of the extremities are not as plump and hard as would be expected in this disease. While many of the peculiar features correspond well with one's conception of a healed or arrested osteogenesis imperfecta, yet there are no observations on record of the bones in survivors from this disease, and there is relatively but little evidence in this case of its

[1] Zeitschr. f. Ethnologie, 1898, xxx. p. 55.

[2] Virchow's Archiv, 1853, v. 409-508.

most striking characteristic, namely, extensive multiple fractures. Were a history obtainable of great brittleness and softness of the bones at birth and for some time afterward, the evidence in favor of osteogenesis imperfecta would be materially strengthened. Undoubtedly the porosis of many of the bones in the skeleton may be ascribed to the disuse incident to the deformities, whatever the real nature of the fundamental cause. In this way a more or less atypical chondrodystrophia hyperplastica might have been succeeded by osteoporosis rather than osteosclerosis, as seems to be the rule, but the porosis is so marked and so general as to suggest general genetic disturbances. A combination of osteogenesis imperfecta with chondrodystrophia, complicated later in life by genuine rickets, might also be suggested. As the matter now stands, final conclusion seems unattainable, and it must suffice to place the case upon record as one example of the grave changes that may be produced in the skeleton by obscure and interesting processes, the real cause and nature of which we do not understand.

A NEW METHOD OF CORRECTING FLEXION DEFORMITY AT THE KNEE-JOINT.[1]

By Royal Whitman, M.D.,
of New York.

No deformity is more difficult to correct satisfactorily than fixed flexion at the knee-joint in the class of cases in which one aims to straighten the limb by movement within the joint and to preserve or to increase its range of motion.

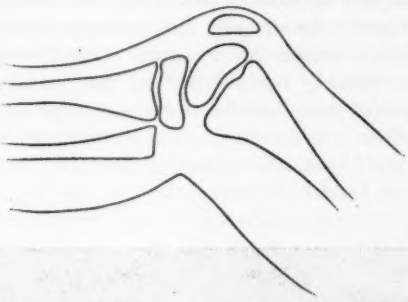
In the attitude of flexion the relaxation of the ligaments permits a considerable degree of mobility, a mobility that is increased if the capsule is distended with fluid or if the ligamentous support is weakened or destroyed. Thus flexion deformity is often complicated by backward displacement and outward rotation of the tibia upon the femur. (Fig. 1.)

In the movement from extension to flexion at the knee the articulating surface of the tibia glides backward from the inferior to the posterior portion of the condyles of the femur. If flexion persists, as it practically always does in joint disease, there is subsequent contraction and shortening of the flexor muscles and of the fibrous structures on the posterior aspect of the joint. In many instances there is also an actual enlargement of the lower extremity of the femur, particularly of the inner condyle, and there are other secondary changes

[1] Read at the meeting of the Harvard Medical Society, December 27, 1902.

within and without the joint that tend to fix the deformity. When, therefore, the attempt is made to straighten the flexed leg the tibia is prevented from gliding forward, and, unless the obstacles to this movement are overcome, the extension is effected with the anterior part of the tibia in the line of the centre of the femur (operative sub-

FIG. 1.

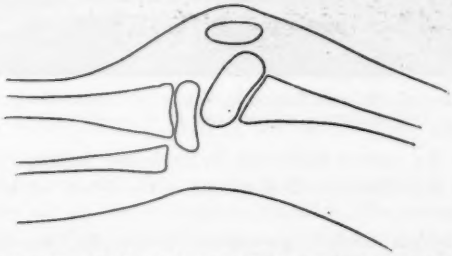


Flexion deformity at the knee-joint, with slight subluxation of the tibia.

luxation). This subluxation is often induced by the attempt to correct deformity, and it is almost inevitably increased if it be present already. (Fig. 2.)

Posterior displacement is an unsightly deformity, and it limits still more, whatever capacity for motion may have escaped the disease. It is also a direct source of weakness and discomfort.

FIG. 2.

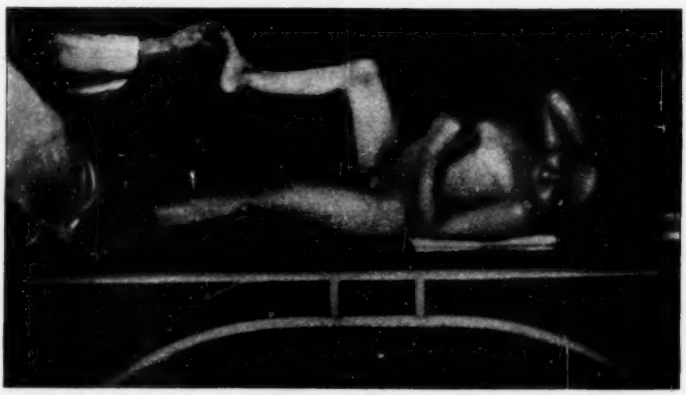


After forcible correction, showing the increase of the posterior displacement. Drawings from the X-ray photographs of an actual case.

Operative subluxation is most often induced or increased by direct forcible straightening of the limb. This is the means usually employed to correct the deformity, because other methods are so unsatisfactory. For example: traction, so effective when flexion is due simply to muscular spasm, is quite inadequate for the treatment of resistant cases. The Bradford-Goldthwait genuclast, a useful appliance for cor-

recting this distortion in older subjects, is not at all suitable for the treatment of children, the class in which it is most common. In fact, osteoclasts of any form should not be employed, because they are more likely to cause fracture or epiphyseal separation than to overcome the resistance of the tissues. The modified Billroth plaster splint, in which the centre of motion is placed, by means of the appliance of Stillman or Bratz, above and in front of the joint, and in which the limb is straightened gradually by wedging the two halves of the plaster apart, is, perhaps, the most satisfactory treatment; but if subluxation is not increased it is certainly not reduced as the limb is straightened. Special machines of complicated design have been devised, but these are excluded from consideration by their costliness, and I know of none that offers any particular advantage over the Billroth appliance, even if it were at hand.

FIG. 3.



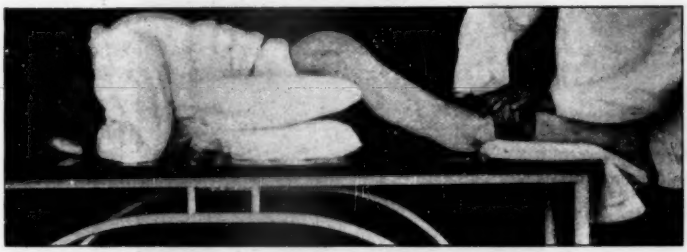
Right angular flexion, with subluxation, the result of tuberculous disease. The patient has Pott's disease and marked deformity of the spine as well.

However the means employed to overcome deformity differ, they are alike in this, that the tibia is used as the lever, while the femur is a fixed point.

During my last term of service at the Hospital for Ruptured and Crippled, confronted by a number of difficult cases of this class, it happily occurred to me that if the ordinary process of correction were reversed, that is, if the femur were made the lever and the tibia were fixed, the danger of subluxation might be avoided; for, as is evident, if a part be fixed it cannot be displaced. On the other hand, extension of the femur on the fixed tibia would tend to force its lower extremity backward, and thus to lessen the degree of subluxation if it were present.

In order to straighten a contracted knee by this method the patient, thoroughly anæsthetized, is turned face downward upon the table. Pillows are then placed beneath the abdomen to accommodate the deformity; that is, the trunk must be elevated sufficiently to permit the anterior surface of the tibia to rest evenly upon the table. (Fig. 3.) This attitude offers no particular difficulty in young subjects, and it has the great additional advantage that the contracted part is uppermost and directly under observation. The operator then holds with one hand the head of the tibia firmly against the table, and with the ulnar border of the other begins forcible massage upon the contracted hamstrings, after the method employed in overcoming the resistance of the adductors in the operation of reduction of congenital dislocation of the hip. (Fig. 4.) In this forcible massage pressure is begun half-way up the thigh, thus exerting a certain extending force. As the resistance lessens the trunk is lowered and the assistant begins to press the thigh

FIG. 4.



Illustrating the method of supporting the body and fixing the tibia before straightening the limb. The folded sheet indicates the degree of subluxation present.

gently downward toward the table, rhythmically stretching and relaxing the resistant tissues, but never with sufficient force to lift the head of the tibia, which is firmly fixed to the table by the operator, reinforced, if necessary, by the hand of an assistant.

If the contraction is of long standing, and especially if subluxation is present, one should not attempt to complete the correction at the first operation, and in certain instances preliminary division of the shortened flexor tendons may be required. When the deformity is corrected or when it is considered advisable to discontinue the operation, a plaster bandage is applied, or, if it is thought desirable, adhesive plasters may be attached to the limb, and strong traction by weight and pulley may be employed. When the flexion has been overcome, the knock-knee, which is usually present, can be easily corrected by gentle force. As the disease, in the majority of cases in which this method is employed, is of a chronic or a quiescent character, a Thomas

knee-brace, provided with traction straps, is finally adjusted, and the after-treatment is conducted in the usual manner.

The principles of this method might be carried out by mechanical devices, but I prefer manual force whenever possible, as it is much less likely to be abused, and, as has been stated, the alternate tension and

FIG. 5.

After forcible correction by the method described. Compare with Fig. 3.

relaxation combined with forcible massage is not only far safer, but it is far more effective than a continuous force of greater intensity.

It is of interest to note that pain following the operation, provided the limb is fixed in a plaster bandage, is slight or absent, nor is there that degree of local reaction that is often observed when gradual reduction is attempted by means of braces and bandages, the so-called

gentle method. This indicates that it is persistent tension on contracted parts rather than the correction of deformity that excites the reaction.

The treatment here recommended is, of course, hardly necessary when the flexion is due to simple muscular spasm; on the other hand, it may be applied to resistant deformity from causes other than tuberculous disease with equal advantage, for example, after gonorrhœal, typhoidal, or other forms of infectious arthritis.

There are cases in which the changes within the joint make it impossible or inadvisable to straighten the limb completely by this or other means. In such cases it is advisable to perform an osteotomy just above the joint; the limb is then straightened and whatever motion is present is thus transferred to a point at which it will be of greatest use.

PRONATION OF THE FOOT.*

By E. J. Huhner, M.D.,

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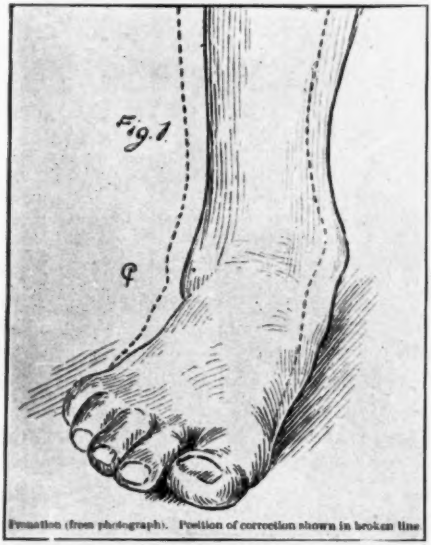
This paper will deal entirely with a pathological condition and not with a physiological function. Pronation is not to be confounded with flat-foot, from which it is distinct. Lovett and Cotton[1] define pronation as "that vicious attitude of the foot in which in habitual standing position it rolls over inward, the inner malleolus projects, and abduction of the front part of the foot occurs."

It is also known as weak foot and weak ankles, and is often an exaggerated or faulty use of a normal position. The cause of pronation is the pressure of the body-weight upon the foot, lifting and carrying heavy burdens. Rheumatism, gout, and rachitis are predisposing causes. Stiff-ankle shoes, by producing weakness of the parts, according to Taylor,[2] cause pronation. Wilson[3] claims comparative freedom from this malformation is noticeable in those who wear sandals or go barefoot. Lovett and Dane[4] are inclined to the belief that modern footwear deprives the foot of a support and the tendency to pronation is favored. The voluntary adduction of the normal foot (Whitman[5]) is about 30°; abduction is somewhat less. The angle of inclination of that part of the foot anterior to the mediotarsal joint was found by Roberts[6] to average in males 34.8°, and in females 31.5°. Abduction, with some pronation, is the normal position when the body-weight is sustained without muscular exertion. This, according to Sampson,[7]

*Read before the Orleans Parish Medical Society, November 22, 1902.

"becomes pathological when excessive or used in other or all attitudes." Abduction is the position of weakness and rest; adduction, that of strength and activity. As to the diagnosis of pronation, the old method of taking imprints on smoked paper, etc., is almost universally condemned as being worthless, except in advanced cases or for verification of other diagnostic measures. The method of Lovett and Cotton[1] to determine the amount of rotation of the astragalus is excellent. The horizontal rotation of the malleoli is determined and used as an index. These measurements, as the originators state, are fairly accurate, though not mathematically so, "as no measure of pronation can be." The amount of deformity may be determined by the plan



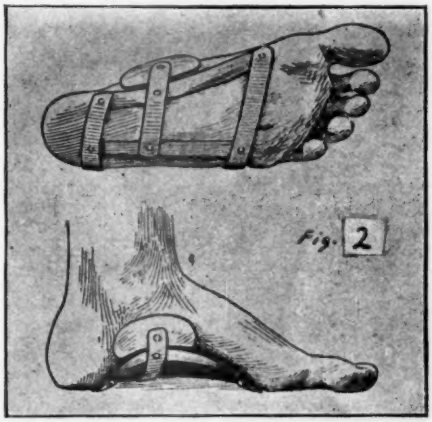
Pronation (from photograph). Position of correction shown in broken line

suggested by Young[6] of taking several photographs upon the same plate with the weight off and on the foot. Briefly stated, the mechanism by which weak foot is produced is as follows:

The head of the astragalus rotates inward and backward, its body forward and outward. This rotation causes the internal malleolus to move backward and the external forward; the front part of the foot is abducted as a whole, and the calcaneum rotates toward a valgus position. In the treatment of pronation strict attention must be given to the footwear. The inner edge of the shoes should be straight; sufficient space is necessary to permit spreading of the toes. Increase adduction: For this purpose Sampson[7] employs a toe-post, fitted in the shoe, between

the great and second toes. Raise the inner side of the shoe. According to Whitman,[9] this frequently is all that is necessary. Tip-toe exercises are given to strengthen the adductors and external rotators of the foot. Often mechanical support is necessary. The ordinary metal plates are objectionable, because they are injurious, interfering as they do with muscular action and inducing atrophy of the muscles of the sole, and, more, they do not directly correct the pronation. Ankle supporters inhibit motion and induce atrophy. Lovett and Cotton[1] have devised an apparatus which reduces these objectionable features to a minimum.

It is light, allows free muscle action, and corrects the distortion. Its most important action is derived from the plate, below the tuberosity of the scaphoid, which exerts elastic pressure outward.



In an examination of the feet of 132 white persons, recently made by me, the result demonstrated the frequency of pronation. The ages of these subjects ranged from eight to seventy-two years; 82 were females and 50 males. Of the 50 males, 9 exhibited pronation in the right foot, 16 in the left foot, and 7 in both feet; in other words, 32 (64 per cent.) were so afflicted. Of the 82 females, 14 presented pronation in the right foot, 18 in the left foot, and 33 in both feet—a total of 65 (about 79.2 per cent.). Of 69 male and female negroes examined, the feet were pronated in about 85 per cent. The excessive occurrence of this deformity in negroes is explained by their occupations, which entail, in the majority of them, almost constant standing and the carrying of heavy burdens. In the cases in the white subjects, abduction determined by Roberts' method varies from 6° to 20°. In three cases the amount of rotation of the astragalus was

found to be 58°, 63°, and 68°, respectively. Pain was very severe in 8 cases. According to my observations, pronation of the feet is more frequent in females than in males. The explanation of this is to be found in the feminine footwear—that is, shoes with high heels, narrow toes, and curved so as constantly to abduct the foot.

In conclusion, I desire to thank Mr. George Augustin for his valued assistance in my search for references, and Dr. John Ridlon, who so kindly gave me permission to use the illustrations in the *Transactions of the American Orthopedic Association.*

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A CASE OF ANEURISM OF THE TRANSVERSE PORTION OF THE AORTIC ARCH IN A GIRL OF NINE YEARS, WITH TABLE OF REPORTED CASES UNDER TWENTY YEARS OF AGE.

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THE patient presented, who is the subject of this paper, was brought to St. Christopher's Dispensary on October 19, 1902, for treatment for pain in the left wrist, and a cough which she had had for some weeks.

Violet B., aged nine years.

Family History. Parents living and healthy; no history of rheumatism or specific infection. Two other children living and well. The oldest child died from pertussis shortly after the birth of the patient. At birth there were no signs of specific disease; there was no cyanosis directly after birth, and the labor was not remarkably severe.

Previous History. When nine days old she had an attack of pertussis which lasted for seven weeks. Until three years of age she had no illness, but at that time had a second attack of pertussis which was very severe, and the cough is said to have lasted for six months. When four years old she is thought to have had rheumatism, as in the extremities there were vague joint pains, which have continued at intervals. Some heart trouble was diagnosed at this time. Typhoid fever at seven; and last July she had measles.

Present History. The cough is rather moist, with at times a clear, watery expectoration; occasionally it is hard and quite brassy in character. There is slight pain under the sternum if the cough is severe. The joint pain, which at present is confined to the left wrist, is sharp

in character, lasting only a short time. With previous attacks there has also been pain in the legs. Sweating is always bilateral; she flushes up on exertion, but equally. Her hands and feet are cold and rather clammy to the touch, becoming more so when frightened, when she trembles and becomes pale, but *never cyanosed*. The negative symptoms are rather instructive, as there has been no œdema, ascites, dyspnœa, palpitation of the heart, headache, or vertigo.

Physical Examination. The patient is tall, rather thin, dark rings about eyes; some protrusion of eyeballs; pupils equal, no contraction or dilatation; sclera, lips, and tongue pale. The superficial veins, especially those of the upper part of the chest, neck, face, and arms, are quite markedly engorged. There is no clubbing of the fingers. Visible

FIG. 1.

wavy pulsation from the second to the fourth intercostal space on the left side, with the maximum pulsation in the third interspace in the midclavicular line. Visible pulsation also in suprasternal notch and the vessels of the neck, slightly more marked on the right side.

Palpation. Thrill, systolic in time, with the maximum intensity in the first right intercostal space, one-half inch from sternal border, extending to the midclavicular line, downward to the third rib and upward into the vessels of the neck; well marked in suprasternal notch, where a pulsating mass can also be palpated. On the left side over the first and second intercostal spaces outward to the midclavicular line. At the apex there is also a slight systolic thrill, which does not seem to be connected with the above. The radial pulses are small, weak, and easily compressible, but regular, the left pulse being slightly slower and

weaker than the right; no capillary pulse. Tracheal tug fairly well marked. The pulsation of the abdominal aorta is not palpable. Dr. Osler[1] remarks that this is a physical sign of large thoracic aneurisms which he had not seen noted.

Percussion. A dull note is found extending from one-half inch on the inner end of the right clavicle to one-quarter inch on the left clavicle; downward to the second rib on the right side and blending with the cardiac dulness on the left. Cardiac dulness extends from the second interspace to the apex under the fourth rib, and one-quarter inch without the midclavicular line; the right border one-half inch to the right of sternum and the left border just without the midclavicular line.

FIG. 2.

Auscultation. There is heard a loud, harsh, rasping murmur, synchronous with and obliterating the first heart sound; loudest over the first right intercostal space close to sternum and in the suprasternal notch. Over the second rib and second right intercostal space the first sound is also obliterated, and the second heart sound markedly accentuated, the murmur ending just before the second sound. Over the first and second left intercostal spaces the first heart sound is not obliterated. The murmur is transmitted down the sternum almost to the xiphoid cartilage; to the right and left axillary region, over both sides of the chest, posteriorly to about two inches below the angles of the scapulæ; less distinctly over the body of the heart. Murmur heard loudly and almost reduplicated over the right carotid, less loudly and single over the left; well marked over entire supraclavicular regions, especially

[1] Practice of Medicine, second edition, p. 710.

on the right side; heard over the trachea. At the apex is heard a systolic murmur distinct from the above, being softer and more blowing, following the first sound, while there is also a very soft, blowing, presystolic murmur. The abdomen is flaccid; no tenderness on palpation. Not tympanitic. The spleen, liver, and kidneys are not palpable.

In this case the cause of the aneurism is a difficult one to determine. It may have been induced by an attack of pertussis shortly after birth, when by severe paroxysms of coughing the wall of the aorta may have been partially ruptured, or at least weakened, and in time the pressure of the blood current on this weakened or torn portion caused dilatation and aneurismal formation.

Again, atheromatous change may have resulted from the rheumatic attacks.

TABLE I.—ANEURISMS IN EARLY LIFE.

a. THORACIC AORTA.

CASE 1. (R. T. Smith, Lancet, 1834, i., 626.) Ascending aorta. Male, aged sixteen years. Diseased aorta, thickened mitral valves. Thinning of walls of aorta, no morbid growth. Sudden onset, sharp, piercing pain in region of heart after having ascended a ladder, followed by insensibility, cyanosis, and death in a few hours. Aneurism, size of walnut, from ascending aorta ruptured into pericardium. Cause: Loss of elasticity in wall, dilatation, rupture on exertion.

CASE 2. (Mr. Hutchinson, Transactions of the London Pathological Society, 1854, v., 104.) Aortic arch. Female, aged four years. Heart and vessels normal. No previous symptoms. Ill ten days with acute idiopathic pericarditis. Aneurism thought to have originated as an abscess and ulcerated into the aorta, the lining membrane of which was healthy to the edges of aneurismal sac. Size of two chestnuts side by side.

CASE 3. (M. Roger, Bull. Soc. Méd. d'Hôp. de Paris, 1863, 499.) Aortic arch. Female, aged ten years; heart normal. No serious illness, rheumatism or scarlet fever. Dyspnœa on exertion for five years. First suffocative attack when eight years old; last one five weeks before examination, lasting all night, with extreme dyspnœa, hanging tongue, pallid face, and cyanosed lips. Dulness in first left intercostal space, size of a two-franc piece. No thrill or visible pulsation. Loud systolic murmur, not obliterating heart sounds. Patient passed from observation.

CASE 4. (Moutard-Martin, Bull. de la Soc. Anat., 1875, 775.) Ascending aorta. Aged two years. Heart hypertrophied; some atheromatous patches in aorta. Family history negative. Dyspnœa for several months. Intense murmur with first sound at base of heart, heard also throughout thorax. Pulse large and compressible. Death due to hemorrhagic smallpox. Pericarditis present.

CASE 5. (G. Thibierge, La France Médical, 1881, ii., 913.) Ascending aorta. Female, aged seventeen years. Aortic valves diseased. Aorta dilated and a few small, discrete fatty patches in wall. Family history negative. Four months before had fever, chills, palpitation of heart, emaciation, extreme grayish pallor, pain in chest, which continued. Visible carotid pulse. Systolic thrill at apex, in first right intercostal space, and in carotids. Corrigan pulse. Loud systolic murmur at base, transmitted throughout thorax. At apex a softer systolic murmur apparently independent of first. In right carotid a strong double systolic murmur, single on left side.

CASE 6. (N. Moore, Transactions of the London Pathological Society, 1882, xxxiv., 71.) Ascending aorta. Female, aged five years. Vegetations on the tricuspid, aortic, and mitral valves. Arteries normal. Death due to tubercular meningitis. Aneurism from the posterior aortic wall; in it several small endarterial growths.

CASE 7. (Sanné, Rev. Mens. de l'Enfance, 1887, 56.) Ascending aorta. Male, aged thirteen years. Heart hypertrophied, aortic valves diseased. Thinning of walls of aorta, with atheromatous patches. Ill for six months, apathetic, dyspnœa, pallid face, cyanosis, extremities cold and clammy. Pulse large but compressible. Thrill over the pericardial region up to right

clavicle. Loud systolic murmur at base, softer diastolic murmur. Death due to asphyxia. Aneurism the size of a small nut.

CASE 8. (Rie, Wiener medicinische Wochenschrift, 1889, xxxix., 556.) Ascending aorta. Female, aged five years. Heart normal. Of two years' duration; palpitation on exertion; pulsation in second and third right intercostal spaces, marked thrill and loud systolic murmur over the same area. Radial pulses small, easily compressible, equal and synchronous.

CASE 9. (A. Pendin, St. Petersburg med. Wochenschrift, 1890, vii., 195.) Ascending aorta. Female, aged twelve years. Heart normal. Fall when six years old, struck right side, causing pain, which continued. No dyspnœa, cough, or hemorrhage. Slight bulging of right chest between second and fifth ribs; dulness over same area with expansile pulsation. No murmurs, but two clear sounds, synchronous with pulsation. Pulses equal, but later than heart.

CASE 10. (E. Willett, Transactions of the London Pathological Society, 1892, xliii., 38.) Descending aortic arch. Male, aged four years. Family history negative. No diseases of childhood. Slight cough for two months. Onset sudden, with malaise, headache, and hallucinations. Ascites and œdema of face and legs. Systolic murmur heard over entire cardiac area. Aneurism thought to be due to a suppurating lymph gland which discharged into the aorta. Death due to pericarditis with a bronchopneumonia.

CASE 11. (R. A. H. MacKeen, Medical News, 1892, lxi., 272.) Aortic arch. Female, aged four years and nine months. Family history negative. No diseases of childhood. Six months before fell striking breast, producing no immediate symptoms. Later a continuous hacking cough and shortness of breath. Pulsating swelling in first left intercostal space, expansile in character; slight thrill; systolic murmur; left radial pulse slowed. No aphonia. Death due to pneumonia.

CASE 12. (A. A. Smith, Medical Record, 1893, xliv., 349.) Ascending and transverse aortic arch. Male, aged eighteen years. Rheumatism one year before. Dyspnœa, extremities always cold. Marked thrill; dulness over ascending and transverse portion of aortic arch; double murmur; thrill in carotids.

CASE 13. (F. J. Smith, Transactions of the London Pathological Society, 1897, xlviii., 53.) Descending aortic arch. Male, aged nine years. Heart and vessels normal. Dyspnœa the only symptom, marked and of sudden onset. Death following tracheotomy.

CASE 14. (S. H. Berry, British Medical Journal, 1898, ii., 1745.) Ascending aorta. Male, aged fifteen years. Slight thickening of the aortic valves. No history of rheumatism or syphilis; no œdema; pupils equal. Dropped dead while playing cricket. Pericardium distended with blood clot.

CASE 15. (G. Bacelli, Semaine Médical de Paris, 1898, xviii., 137.) Aortic arch. Male, aged seventeen years. Family history negative. Acute articular rheumatism at fifteen years of age. No previous illness; no dyspnœa, pain, or palpitation of heart. Six months before present time there was pain in left knee and elbow radiating from shoulders to spine, accompanied by fever. Swelling in pericardial region; thrill of maximum intensity in jugular fossæ and second right intercostal space. Two murmurs; first harsher and best heard in second right space, the second over the sternum. Left radial pulse stronger than right.

CASE 16. (I. Burn Murdock and D. A. Welsh, Edinburgh Hospital Report, 1900, vi., 84.) Ascending aorta. Male, aged twelve years. Aortic and mitral valves diseased. Heart hypertrophied. Vessels normal. Family history negative. Congenital heart disease discovered when three years old. Delicate, sallow complexion, frequent cough, fair muscular development, slight clubbing of fingers and toes, superficial veins of extremities engorged; wavy pulsation in third and fourth left interspaces, visible carotid pulsation. Rough thrill over base of heart. Cardiac dulness increased one-half inch to right of sternum. Rough systolic and diastolic murmurs heard in aortic area, over sternum, in vessels of neck and body of heart. Heart sounds obscured. Death due to ulcerative endocarditis.

CASE 17. (Author's case, 1902.) Transverse aortic arch. Female, aged nine years. Heart hypertrophied; vessels normal. Family history negative. Pertussis and rheumatism. Pain in left wrist, cough, shortness of breath on exertion, pallor, and cold extremities. Engorged superficial veins of chest, face, neck, and arms. Pulsation over cardiac region, suprasternal notch and vessels of neck. Thrill on both sides of sternum to third rib and in supraclavicular fossæ; also a distinct thrill at apex. Tracheal tug. Radial pulses small, weak, and compressible; left pulse slower and weaker. Dulness over first and second interspaces near sternum. Heart increased one-half inch to right of sternum. Loud harsh murmur over dull area, heard less distinctly throughout thorax. Systolic and presystolic mitral murmur.

b. ABDOMINAL AORTA.

CASE 18. (Dr. Miguel, Bull. Général de Thérapeutic, 1835, lx., 393.) Abdominal aorta. Male, aged fourteen years. Heart normal; aorta narrowed and friable. Indisposed for two weeks;

lumbar pains, difficulty in walking, diarrhœa, pulse weak, and prostration. Death sudden, due to rupture of aneurism.

CASE 19. (Dr. Armitage, Transactions of the London Pathological Society, 1857, ix., 85.) Abdominal aorta. Female, aged seven and a half years. Heart and vessels normal. Palpitation of heart from infancy; aching in legs, knees, and wrists when erect. Heart action violent. Systolic bellows sound at mitral areas. Sudden death due to rupture of aneurism.

CASE 20. (Dr. Phanomenow, Arch. für Gynäkol., 1881, xlviii., 133.) Abdominal aorta. Fœtus. Caused dystocia from its size.

CASE 21. (C. F. C. Lehlbach, reported by A. Jacobi, Transactions of the American Pediatric Society, 1889, i., 227.) Abdominal aorta. Female, aged five years and three months. Heart normal. Parents died of tuberculosis. Pertussis and measles only diseases When four years old, while jumping, felt pain in right leg, which continued and caused a limp. Operation later found pus and destruction of head of femur. Death due to tubercular meningitis.

CASE 22. (R. T. Aitken, British Medical Journal, 1898, i., 1655.) Abdominal aorta. Male, aged nine years. Heart hypertrophied; atheroma of aortic arch. Had several rheumatic attacks. Complained of pain in the chest. No circulatory changes. Death due to embolism.

CASE 23. (N. N. Alexejew, Dietkaja Medicina, 1898, iii., 167.) Abdominal aorta. Female, aged ten years. Vegetations on mitral valves. Pain and depression for eight weeks. Palpable pulsation under the umbilicus. Pulse in left crural artery smaller than right.

TABLE II.—CASES OTHER THAN AORTIC.

CASE 24. (A. F. Voolker, Transactions of the London Pathological Society, 1893, xlv., 51.) Aortic valve. Female, aged one and a half years. No other valvular disease; some endocarditis of aortic valve. Death due to capillary bronchitis.

CASE 25. (N. Pitt, Transactions of the London Pathological Society, 1893, xlv. 51.) Aortic valve. Sex not stated, aged eleven months. No endocarditis present. Death.

CASE 26. (Martin, Bull. Soc. Anatomie, 1827, ii., 17.) Ductus arteriosus. Sex not stated, aged one month. Aneurism found to be the size of small nut, filled with a clot and impervious.

CASE 27. (J. Hoffnung (1), quoted by A. Jacobi, reprint from Proceedings of Tenth International Medical Congress, 1891, 7.) Branch of pulmonary artery. Female, aged ten months. In the upper lobe of the left lung was found an aneurism the size of a hazelnut, containing a firm parietal thrombus. Death due to hæmoptoë.

CASE 28. (F. Rasmussen (2), quoted by A. Jacobi, reprint from Proceedings of Tenth International Medical Congress, 1891, 7.) Branch of pulmonary artery. Female, "very young." A small aneurism which had ruptured was found in lung. Patient had pulmonary phthisis. Sudden death in an attack of hemorrhage.

CASE 29. (F. Rasmussen, quoted by A. Jacobi, reprint from Proceedings of Tenth International Medical Congress, 1891, 8.) Branch of pulmonary artery. Male, aged three and a half years. Aneurism had ruptured into a cavity. Patient phthisical. Sudden death during hemorrhage.

CASE 30. (O. Wyss (3), quoted by A. Jacobi, reprint from Proceedings of Tenth International Medical Congress, 1891, 8.) Branch of Pulmonary artery. Sex not mentioned, aged one year. During an attack of capillary bronchitis with infiltration at right apex, vomiting and coughing followed emetic, and with it a large amount of clear red blood from nose and mouth. Death immediate.

(1) E. Henoch, Vosleo. über Kinderkrankheiten, 1889, Aufl. iv., S. 412.

(2) Hosp. Tidende, xii., Nos. 11, 12.

(3) B. Gerhardt, Handb. d. Kinderh., 111 (2), S. 807.

CASE 31. (J. Sykes, Philadelphia Journal of Medical and Physical Sciences, 1823, xi., 139. Carotid. Female, aged eighteen years. Fell from a horse two years before. Aneurism the size of a goose's egg. Cured by ligature above and below; not divided.

CASE 32. (Kingston, Edinburgh Medical and Surgical Journal, 1842, lvii., 69.) Right carotid. Male, aged fourteen years. Heart hypertrophied, valves normal. Vessels atheromatous. Pulsation for two years. Some pain and difficult deglutition; became larger on exertion. Sudden onset of symptoms, including a right hemiplegia and aphasia. Aneurism of basilar artery also found. Death due to embolism.

CASE 33. Mr. Hodgson, mentioned by T. Smith, British Medical Journal, 1867, i., 280.) Carotid. Female, aged ten years.

CASE 34. (K. C. Bose, Indian Medical Gazette, 1888, xxiii., 209.) Facial. Sex not mentioned, aged one year. Traumatic origin.

CASE 35. (Sir Wm. Gull, 1857, quoted by Parker, Med. Chir. Trans., 1884, lxvii., 51.) Axillary. Female, aged fourteen years. Aortic valves diseased. Vessels normal. No rheumatic or specific history. Left hemiplegia developed during sleep. Death due to cerebral hemorrhage

Case 36. (Wm. C. Mardorf, Medical Review, St. Louis, 1898, xxxvii., 361.) Left axillary. Female, aged nine days. No thrill. Had disappeared when she was seven months of age.

Case 37. (G. Pollock, British Medical Journal, 1886, ii., 1033.) Brachial. Male, aged fourteen years. Vegetations on the aortic valves. Aneurism first seen three days before admission to hospital. Death due to embolism.

Case 38. (Joubert, quoted by Bramann, Arch. für klin. Chir., 1886, xxxiii., 22.) Brachial. Male, aged eighteen years. Spontaneous origin. Cured.

Case 39. (W. W. Keen, Medical News, 1887, li., 725.) Brachial, also an aneurism in thorax. Female, aged eighteen years. Heart normal. Spontaneous origin. Above outer third of right clavicle there is a thrill and bruit; heard also over the right carotid and subclavian.

Case 40. (Ogle, 1865, quoted by Parker, Med.-Chir. Trans., 1884, lxvii., 51.) Ulnar. Male, aged seventeen years. Mitral valves diseased. Vessels diseased. Sudden unconsciousness, aphasia, and right hemiplegia. Death.

Case 41. (Z. Wornarski, Australian Medical Journal, May 15, 1884.) Interosseous of hand. Female, aged twelve years. Heart normal. While lifting a weight felt something give way in left hand; noticed pulsating swelling in palm. Family history negative. No rheumatism or scarlet fever. Cured by operation.

Case 42. (W. W. Keen, Medical News, 1887, li., 725.) Interosseous of hand. Female, aged eight years. Due to strain while exercising.

Case 43. (N. Moore, Transactions of the London Pathological Society, 1882, xxxiv., 71.) Right common iliac. Female, aged seven years. Heart hypertrophied, vegetations on aortic and mitral valves. Vessels normal. Rheumatic history. Ill for six weeks; double murmur heard at base, systolic murmur at apex; clubbing of fingers and toes. Death due to embolism.

Case 44. (H. H. Clutton, Transactions of the London Clinical Society, 1892, xxvi., 7.) External iliac. Male, aged six years. Ligature above and below aneurism. Cured.

Case 45. (Grundy, London Medical Gazette, 1834, xiii., 509.) Femoral. Male, aged nine years. Received a kick in thigh eighteen months before. Healthy up to that time.

Case 46. (T. Smith, British Medical Journal, 1867, i., 280.) Common femoral. Male, aged twelve years. Aortic valves diseased. Vessels normal. Three months before while running felt a sharp pain in the right groin, followed by a pulsating mass, over which could be heard a bruit. Rough systolic murmur at base of heart. Cardiac dulness increased. Veins of chest prominent. Is said to have died some years later of internal (aortic?) aneurism.

Case 47. (Habershon, quoted by Parker, Med.-Chir. Trans., 1884, lxvii., 51.) Femoral. Male, aged sixteen years. Aortic and mitral valves diseased. Cerebral arteries diseased. Rheumatic fever twelve months before; ulcerative endocarditis on admission. Died comatose after convulsions.

Case 48. (R. W. Parker, Med.-Chir. Trans., 1884, lxvii., 51.) Common femoral. Male, aged twelve years and seven months. Heart hypertrophied. Aortic valves diseased. Vessels normal. Family history negative. Disease of hip-joint due to injury when two years of age. Sudden pain in left groin followed by swelling. Pale, emaciated, clubbed fingers and toes. Pulsating swelling over femoral artery. Aortic systolic and soft mitral murmurs.

Case 49. (O. von Bungner, Arch. für klin. Chir., 1890, xl., 312.) Left femoral. Male, aged seventeen years. Mitral valve diseased. Narrowing of vessels. Attacks of polyarthritis when eight, thirteen, and sixteen years old, resulting in cardiac disease. Swelling appeared suddenly.

Case 50. (R. Johnson, Transactions of the London Clinical Society, 1898, xxxi., 288.) Right femoral. Female, aged twelve years. Patient thin, pale, clubbed fingers. Rheumatic fever two years before, again two months before present history. Pain and lameness for nine months. Cured by operation.

Case 51. (Syme, London and Edinburgh Monthly Journal of Medical Science, October, 1844, 823.) Popliteal. Male, aged nine years. Swelling for two years which disappeared on pressure. Caused no symptoms. Cured by tying the femoral artery.

Case 52. (Boling, quoted by Bramann, Arch. für klin. Chir., 1886, xxxiii., 38.) Popliteal. Male, aged sixteen years. Spontaneous origin. Pain for six months; swelling back of knee. Amputation.

Case 53. (Madrazo, Écho Médical Toulouse, 1858, ii., 93.) Popliteal. Male, aged fifteen years.

Case 54. (A. T. Norton, British Medical Journal 1891. i., 852.) Left popliteal. Male, aged seventeen years. Pain for five months, with swelling and expansile pulsation, over which was heard a systolic bruit. Cured by operation.

Case 55. (Terrier and Hartman, Medical Record, 1893, xliv., 237, abstracted from Lancet.) Right popliteal. Male, aged seventeen years. Sudden pain in right ham, with swelling and redness. Operation disclosed exostosis at lower end of femur, which caused rupture of artery and aneurismal formation.

CASE 56. (Sir A. Cooper, Lectures edit. Tynell, 1824, ii., 40.) Anterior tibial. Male, aged eleven years.

CASE 57. (Moulinié, Journal Hebdomod., 1832, ix., 226.) Anterior tibial. Female, aged nineteen years. Aneurism became large. Ligature of anterior tibial followed by amputation on account of hemorrhage. Death.

CASE 58. (Clive, 1824, quoted by Sir A. Cooper.) Dorsalis pedis. Male, age not given.

CASE 59. (G. M. Withe, reported by A. Jacobi, reprint from the Proceedings of the Tenth International Medical Congress, 1891, 8.) Right external iliac and femoral. Female, aged seven years. Vegetations on mitral valves, thickening of aortic valves. Narrowing of aorta. Rheumatic and gouty family history. Rheumatism when three years of age; well-marked valvular lesion. Aneurism of left femoral appeared first, followed by tumor in the right inguinal region. Death due to malignant ulcerative endocarditis.

CASE 60. (Eppinger, quoted by A. Jacobi, reprint from the Proceedings of the Tenth International Medical Congress, 1891, 6.) Multiple of the heart. Female, aged ten years. Large number of aneurisms in the heart muscle and along the walls of the coronary and intercostal arteries. Death.

In going over the literature relative to extracranial aneurism in early life, there have been noted sixty cases under twenty years of age.

The seat of the aneurism: in 18 cases, the thoracic aorta; 5 cases, the abdominal aorta; 2 cases, aortic valves; 1 case, the ductus arteriosus; 1 case, multiple aneurisms of the heart; 4 cases, in branches of the pulmonary artery. The remaining cases are distributed among the arteries which supply the extremities.

Going somewhat further into detail in regard to the aortic aneurisms, we find that sex plays an unimportant part in early life: ten cases males, eight cases females, two cases with sex not mentioned.

In regard to age, there are fourteen cases under twelve and nine cases over twelve years.

The etiology for the most part is obscure; in six cases there was no history of syphilis, rheumatism, or severe illness. Two cases in which traumatism was the cause. Two cases with sudden onset after exertion (climbing a ladder and playing cricket). Three cases with a history of rheumatism. One case thought to have been due to an abscess which ulcerated into the aorta. One case thought to have been due to a suppurating lymph gland discharging into the aorta.

The condition of the heart: in eight cases the heart is stated to have been normal; two cases of hypertrophy; one case of hypertrophy with disease of the aortic valves; one case of hypertrophy with disease of the aortic and mitral valves; three cases with diseased aortic valves; one case with diseased aortic, mitral, and tricuspid valves; one case with diseased mitral valves. There was thinning of the aortic walls in two cases, and in two others there were some atheromatous patches in the wall of the aorta.

With few exceptions the cases cited were under observation a short time only; of these, one case is thought to have existed for six years. At that time there is the history of a fall, followed by pain in the chest, which continued at intervals with no other symptoms (Case 9).

In another case there is a history of dyspnœa on exertion for five years, with successive attacks two years before she came under observation (Case 3).

A third case is one with a history of rheumatism two years before, followed a few months later by pain in the left shoulder (Case 15).

In the majority of cases death has been sudden. The causes as found have been: three cases of rupture, two cases of acute pericarditis, one case of ulcerative endocarditis, one case of embolism, and one case due to aphasia.

Few symptoms are given, dyspnœa on exertion being the most common; pain of variable intensity, cough, pallor, cyanosis, and rarely clubbing of fingers and toes, distended superficial veins, visible pulsation, and bulging over aneurism.

SOME NOTES ON THE OPIUM HABIT AND ITS TREATMENT.

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In the opening note to his *Tramping with Tramps*, Josiah Flynt writes: "During my university studies in Berlin I saw my fellow-students working in scientific laboratories to discover the minutest parasitic forms of life, and later publishing their discoveries in book form as valuable contributions to knowledge. In writing on what I have learned concerning human parasites by an experience that may be called scientific in so far as it deals with the subject on its own ground, and in its peculiar conditions and environment, I seem to myself to be doing similar work with a like purpose."

With some such similar point of view I present the following brief note on the study of some phases of the "opium habitué" in the "open."

In a recent discussion held before the New York Academy of Medicine on the subject of alcoholism, Dr. M. Allen Starr made an interesting series of comments, saying, among other things, that one is inclined, when speaking on the subject of alcoholism, to assume that inasmuch as all spirituous liquors contain alcohol, the effects are all alike. This, he emphasized, was a gratuitous assumption, and further showed that the results due to drinking different types of alcoholic liquor were very diverse if one would think of the psychological manifestations. Thus he brought out different temperamental

variations as produced by such drinks as sherry, port, champagne, and Burgundy. These differences, he said, are due, perhaps, in part at least, to the varying composition of the drink in question, and any discussion of the alcohol question should take such differences into account.

In much the same manner it is assumed by many, if not most, that the opium habit is just the opium habit, and "there 's an end on 't;" but such is far from being the case, and I know of no psychological problem that offers a more extended gamut of individual variation than this. Its developmental history, various forms, associated customs, and devious endings are extremely multiplex; and personally I hesitate to use the general term, since to my mind, at least, it offers so few tangible conceptions. Moreover, the laying down of general rules concerning its treatment, so far as my own experience is concerned, is fruitless. The habit is a complex social-psychological network, and its treatment should take into consideration the many factors that enter into it.

An interesting field for speculation concerning this habit lies in its consideration as a "social disease," viewing for the moment society as an organism, as Spencer has so interestingly done in his *Principles of Sociology*. From this outlook the study of the opium habit would legitimately take into consideration the various types of the disease or habit; the incidence or morbidity of the affection; its causative factors, under which general head particular attention should be paid to special factors—foci of infection, I believe they might very reasonably and rationally be termed. The modes of propagation are almost as definite, and the more one sees of the habitués the fewer seem the avenues along which they have travelled to arrive at the final goal of complete destruction.

Following along some such scheme as this, the ordinary manifestations of the affection would make the next legitimate subject of inquiry. On this point it is not my purpose to dilate, but I believe, from a thorough study of most of the literature of the past ten years, that many vital points have been completely misinterpreted in this affection. Most writers are prone to be influenced by their so-called moral bias, and seem to be unable to approach this question with an unprejudiced mind. This is well illustrated by the tempest in a tea-pot in our daily and medical press which arose from a recent statement of Rudyard Kipling concerning the use of opium in the Oriental countries. It is very difficult in any sociological problem to understand one's own place in one's own environment; it is, therefore, doubly difficult for a European or American to appreciate the Oriental, and, indeed, it is fruitless to discuss such far-away matters when there is plenty of food for reflection at home.

The treatment, both prophylactic and actual, would conclude the outline of a paper such as I have suggested. This, too, is extremely broad in its scope, and requires an intimate knowledge of the personality of the sick individual. To handle it in all of its phases is almost impossible apart from a monographic analysis.

Two sharply dividing lines can be drawn, however, between the sanatorium and open modes of treatment. They are very distinct, and I hope to say more about this when the subject of treatment is reached. In the present paper I have touched here and there only on the framework just outlined.

The general classification of the types of this affection may be entered on with some degree of certainty.

As far as the general grouping of the different types of habit is concerned, three main divisions appeal to my experience. Opium-takers may be classed as those who take the drug in the form of some one of its official preparations—laudanum, paregoric, the extract, etc., by the mouth, by the rectum, by the vagina, or other natural orifice; a second and very large class, if not the largest, absorb the drug through the respiratory mucous membrane by means of the pipe or by smelling; the third class includes those who take morphine or allied products by the mouth, or subcutaneously by the hypodermic syringe. New York City affords an excellent *locale* for observing the three main types of addiction mentioned.

INCIDENCE. It is futile, at the present time, to attempt to compute the number of people who use this drug; but there can be no doubt that its habitual use is very extensive and its occasional indulgence enormous.

Without going into this question too extensively, a few side lights gathered from prison records and from the experience of those associated with the classes who are prone to this habit make it apparent, to me at least, that the frequent use of opium for purposes of pleasure is enormous and beyond computation; and that its habitual use is certainly distributed in New York City among about 30,000 individuals. These figures are founded on very meagre statistics, yet in the course of this inquiry much collateral information has been gathered which gives some support to this general statement.

Of the incidence of this habit in other places, Dr. A. P. Grinnell,[1] of Burlington, Vt., has given the profession the results of one of the few systematic inquiries regarding the prevalence of any drug habit in a limited area. He instituted a series of inquiries among the druggists and sellers of general merchandise in the State of Vermont, endeavoring to obtain an accurate account of the quantities of narcotic drugs

[1] Medico-Legal Journal, September, 1901.

sold. His returns were but fragmentary, and are by him computed as representing but one-fifth of the total sales, yet they indicate that over three million doses of opium are sold in Vermont every month; or, stated in another way, that every man and woman over the age of twenty-one years receives at least one and one-half doses (1 grain equivalent) of opium daily.

If it is shown that the 3,300,000 doses of opium are taken monthly by a population of 187,000 people—almost twenty doses a month for the entire population—it can readily be seen that this consumption is hardly the normal consumption due to its medicinal use, but must be produced by a large number of habitual takers.

This assumption almost reaches a positive demonstration in fact when it is made apparent that the figures given and dosage represent about one-fifth of the actual consumption. It is to be regretted that Dr. Grinnell could not give us some working figures as to the number of individuals using opium habitually, but this is almost an impossible task.

For some time past the subject has interested me, and I have made some endeavor to get some light on the "morbidity" or "incidence," if I may use the word, of this habit by a side light from a different source. This has been the study of the number of "patent cures" that are placed on the market. As yet my inquiries have not yielded me definite data, but they are sufficiently advanced to warrant the belief that this will make a very profitable social study, and will give definite information bearing on the prevalence of the habit. The details of the method pursued and the mode of analysis I hope to present in a later paper bearing on the subject. The present communication I consider as a preliminary survey of a very broad field which has had very few workers who have made other than purely clinical studies.

Psychology. It is not the intention at the present time to discuss at any length the psychology of this type of habit. Such a discussion would lead one into interesting and perhaps profitable paths, but a complete exposition of the mental states accompanying this habit would lead away from the main purpose of the paper. I think that the most important element in the psychological analysis is the recognition of temperamental variations; not meaning by that the crude differentials of the phrenological pseudoscientific advocates, but one based upon more elementary and radical differences—a subject which is still in an unsatisfactory condition because of insufficient analysis of normal mental activities.[1] Not every opium habitué passes through the stages as portrayed in the glowing colors of De Quincy; in fact, my own obser-

[1] See F. Paulhan. Les Caracterse. Second edition, 1902.

vation would tend to show that but a very few have the temperamental type of De Quincy, to say nothing of his literary ability, and hence do not respond in a similar manner. This is a subject, however, that requires much analysis.

I believe that the fundamental psychological factors in the opium habit closely resemble those found in other drug habits, and that the phenomena noted for the opium habit have many features in common with those noted for the alcohol habit. This is not referring at all to similarities or dissimilarities in the physiological activities of the two drugs, but rather to the conception of what feelings the taking of the drug as an entirety, apart from individual sensational variations, gives the individual, and why he is induced to continue and why it is difficult for him to stop.

It is well known that the habit of taking intoxicants is extremely ancient, and history tells that primitive peoples used the natural intoxicants that developed in their environment. The antiquity and polygenetic origin of the alcohol habit, for instance, is admitted by all students of this habit. The use of coca has a similar antiquity, if distributed over a more restricted area. The history of the use of cannabis indica and of mescal has been preserved in the most ancient of literatures, and the pleasures of the poppy have been sung by poets and preserved in literature as old as the Pyramids.

The early religious associations of antiquity that have clustered about the use of the intoxicating properties of alcohol may have had their analogues in the peoples of the East, but my information is too scanty to warrant extended conjectures along this line. Most of the drugs used by the priests or leaders in early religious sects were of the exciting type. Frenzy and delirium were the states desired; and whether the mild states of excitement induced by the use of opium were ever utilized by those engaged in the business of religion I have as yet been unable to ascertain beyond the merest references to general practices. Thus, Dawkins[1] speaks of the early cultivation of the poppy by prehistoric (neolithic) man, but if for the purpose of joy alone or for those combined with religion I am not competent to speak. Partridge[2] has given one of the best of recent summaries of this interesting topic. But passing from early times to the present, and omitting all consideration of the many functions and ceremonies that have had bound up in their past performance some use of this drug, what is it that the present-day habitué—dully oblivious, for the most part, of the folk-lore of the past and keenly seeking an oblivion from the worries of the present—what is it that the use of this agent gives him?

[1] Early Man in Britain and his Place in the Tertiary Period.

[2] Studies in the Psychology of Alcohol. American Journal of Psychology, 1900, vol. xi. pp. 328-376.

It is a well-known pharmacological fact that the stimulant narcotics are capable of affecting consciousness in two opposite ways: they either increase or diminish the intensity of the incoming stimuli, and this heightens or clouds the waves of conscious impressions. According to the evolutionary point of view adopted by Partridge in discussing the subject of alcoholism, the habitué may be regarded as one in whom the craving for intense states of consciousness is overdeveloped, or who is lacking in control, or one who, usually as a result of pain, has an abnormal craving to revert to a state of consciousness which is less intense.

It is in this latter group that the great class of opium habitués may be classed. If he has acquired the habit, so soon as distressed or painful—sometimes termed nervous—sensations commence to crowd into his consciousness, then it becomes necessary for him to attempt to revert to a state of consciousness which is less intense and more agreeable.

Much more can be said on this topic, but I must defer it until a later period. The subject of symptomatology I shall omit entirely. Its many and diverse manifestations would warrant an entire paper; still under the head of some illustrative cases I hope to bring out a few facts that I have never seen recorded even in a wide reading.

TREATMENT. To assume that the attempt to cure the opium habit is an *ignis fatuus*, and that if once this habit has been acquired it is something that can never be shaken off, is an idea, for medical minds at least, that should not be entertained for an instant. Such an idea, I believe, has a prophylactic and preventive influence on the laity, and an endeavor to make it as forceful as possible is distinctly justifiable. The hell of the confirmed habitué cannot be too strongly colored if by so doing one may prevent any from entering therein. But while a pessimistic attitude on the part of the physician concerning the possibility of recovery has a certain justification from the transitory character of their ministrations, still for those who see such patients for considerable periods of time and in large numbers it is not a helpful or a correct attitude.

It should constantly be remembered that there are great variations in the intensity of habits of this kind. It has already been said that there are great numbers of pleasure habitués for opium—people who take it when they like and do not when they do not; of these I have seen many, and particularly is this true of smokers. Again, there are those in whom the desire comes as does the desire of the dipsomaniac. They go on a "dope debauch," remain under the influence of the drug for a week or two weeks, are sick, and then do not touch it again for a month, a year, or, as in one of my patients, three years; and yet this patient was a steady smoker from the age of sixteen to twenty-five years, and gave it up on moving to another city. On returning to New

York, as he does at infrequent intervals—six months, one year, or two years—he hunts up his old-time associates and has a session as in days of yore.

Cases are numerous in which the patient has voluntarily given up the drug and has never taken it again. This I know to be true of those addicted to all types of the habit—crude drug or its preparations, pipe, and even the "gun" or hypodermic. In the literature numerous instances are recorded. One of the most recent and striking is reported by W. E. Taylor:[1]

"The case reported is that of a laborer who had been using from 20 to 30 grains of opium daily for sixteen years, and who, without medical assistance or any encouragement whatever, broke off the habit suddenly, notwithstanding severe pain, insomnia, and other physical distress lasting for six weeks. At the end of three months he was perfectly cured, and at the end of nine months had not taken opium in any form, and did not crave it."

Histories of this kind are very frequent, I believe; but it is difficult to obtain them, because the former habitué recognizes the imperfections of society, with its lack of sympathy for many of its members, and the all-too-ready tendency of certain individuals to grasp an opportunity to injure another if good to self can come thereby in actuality or even in hope; and thus he hesitates to let even his friends know of this dark chapter of his life, because of their lack of comprehension of what it really means and their tendency to avoid him in the future. When it is remembered how pessimistic many are regarding the cure of this affection, reticence is by far the wisest course, else perhaps his friends will still believe that he practises the habit, and will trim their social sails to this wind of interpretation; and every alienist knows how simple it is to see insane actions in isolated happenings if once the idea has arisen that such an interpretation is possible.

The type of steady smoker of whom I have already spoken, for the most part, does not desire to get over his habit. He is able to attend to business—a banker, broker, actor, vaudeville performer, drummer, confidence man, gambler, race-track attendant, or bum, for thus the gamut runs; he is able to do his routine work, and spends his hour or two in the pleasures of the poppy every day or every other day, as the case may be. For a number of years he continues this, and does not suffer to any great extent. When sudden intercurrent disease comes, the strain tells, and pneumonia, typhoid, dysentery, gastritis, prove fatal with apparently greater frequency than among those non-habituated. This, I think, is particularly true of habitués who suffer from gastric and intestinal disturbances.

[1] Journal of the American Medical Association, June 22, 1901.

Very frequently, however, some slight intercurrent trouble throws these patients out of their stride, and it is interesting to see with what regularity they commence to take some type of "cure." They rarely consult a physician—unless a broken-down fiction of one, himself a helpless slave—in this early fright, but almost invariably fly to one of the patent specifics, of which there are legion, and concerning the claims of which I hope to be able at some future time to present a complete analysis—a subject which has been of interest ever since an appreciation of the extent and the scope of the patent-medicine business began to dawn upon me.

Many of these patients recover during these spasmodic reforms, and recover by means of the patent medicines. This I know to be a truth. But for those who would consult the general practitioner, seeking something better than the oft-repeated counsels of their fellow-sufferers, what advice can we offer which will appear rational to one who has tried countless specifics and sought advice from numerous sources?

It is here that the sharp line must be drawn between the sanitarium and the outside patient. In the former instance let the physician in charge of the sanitarium worry about the case. With him almost any mode of procedure is going to result in a temporary cure at least. For the man or woman who earnestly desires to overcome a habit, and yet is to be permitted to attend to business or the avocations of society, the problem is much more difficult of solution, if not at times impossible.

The cardinal principles on which a rational therapy are to be founded consist, I believe, in the substitution of different ideas by suggestion and the substitution of different sensations by other drugs. These two factors, if judiciously combined, will certainly be of service in the most intractable cases.

It is necessary in the first place, however, to obtain some relief from the actual sufferings of the morphinomaniac before one can use mental influences, and therefore the principle of substituted sensations must first be brought into play.

Many drugs have been employed to bring about this purpose, but practically none have been of service outside of sanitaria or in patients confined to rooms and under surveillance. For such my own experience confirms that of many others, that the bromide method is one of the very best. This method, of late years, has been termed the Macleod method, but as an actual fact the use of bromides is much older—how old no one can now say. The details of this method are as follows: 120 grains of sodium bromide are given in half a tumbler of water, every two hours during the daytime, until 1 ounce has been administered in the same day. This may be sufficient to produce the "bromide sleep," or the drug may have to be continued on the third day. It is a safe rule to stop the administration after twenty-four

hours if the drowsiness is so profound that the patient cannot be aroused from sleep to take further doses, or when aroused is incoherent, since it is to be remembered that the drug acts in a cumulative manner. After the second or third day of the sleep, which may even deepen into coma, the bromide is withdrawn. There is usually some difficulty in feeding the patient, swallowing being sometimes impossible, so that rectal alimentation has to be practised; and a tendency to aspiration pneumonia, which occasionally manifests itself, makes feeding by the mouth doubly dangerous.

This plan of treatment was, it seems, discovered accidentally. Macleod states that early in 1897 a neurasthenic woman, who had been addicted to morphine for nine years, by accident received doses of over 2½ ounces of sodium bromide in a little over two days. A profound sleep was induced, lasting several days, and when its effect wore off the craving for morphine had ceased, and with it the various disturbances which had led to its use.

Any septic condition of the pharynx or of the nasopharynx or the mouth should contraindicate the method, and a weak heart or impaired pulmonary conditions are to be regarded as strong contraindications. It has been suggested that sodium bromide in large quantities has a distinctly harmful effect upon the kidneys, and therefore any degree of nephritis is to be regarded as a barrier to the "bromide sleep."

Although the bromide plan of treatment is far from being simple and unattended by danger, yet compared with the dangers attending the ordinary treatment for the morphine habit it seems to be of marked value in well-selected cases, and in such the writer would not hesitate, under appropriate safeguards, to employ it.

Of the use of hyoscine in comparatively large doses, as advocated by many on the introduction of this drug, and recently commended by Drs. Lott and Hare, my own experience is contradictory. It has proven of good service in stages of marked excitement, but its use has given me more than one unpleasant shock in that dangerous collapse has followed its administration.

Inasmuch as the chemistry of this group of alkaloids is in a most unsatisfactory state of uncertainty, very few of them being pure products, hyoscine should be pushed with much caution.

While being the last one to hold forward a single remedy for the treatment of such a complex condition, it seems that if once one is enabled to relieve the habitué of the sense of ennui and unrest that afflicts him at the recurrence of his dosage time—be it once in six hours, or twelve, or every day or two, as the case may be—then with the relief given at such a time by other means than by morphine a point is reached where other means of influencing the patient are more liable to be of effect, both temporary and lasting.

Much has been claimed of the newer morphine modifications—heroin, dionin, and peronin—within the past few years as fulfilling this very indication. From a somewhat extended use of these remedies I believe this to be in part true; but they are by no means as efficient as many have been led to believe, as I think, from too hasty a recital of the results. In the earliest days of my experience with these drugs the belief was engendered that Eldorado had been found; but after waiting three to six months it became apparent that in some cases I had simply substituted one habit for the other, and it is still an open question as to which is the more desirable one.

Many observations have been made on the use of these remedies. The most valuable by far is that of Morel Lavallée,[1] who treats of heroin alone. He brings out, in sharper contrast than is warranted in my own experience, differences in the use of morphine and heroin. Thus if to a healthy man a hypodermic injection of morphine be administered the effects that follow are, as is fairly well appreciated, a blissful feeling of tranquillity accompanied by a sharpening of the intellectual faculties. All anxieties are forgotten in the pleasure of simply living. As far as the habitué is concerned, he feels his strength and his usual vigor return; all his lassitude disappears. The non-habituated man feels his whole body thrill with a pleasant glow that seems to run through his blood. His pulse is quickened and his respiration diminished. It is chiefly this sense of living warmth which is the secret charm of the physiological effect of morphine, and which is called "euphoria." There is also a physical sense of pleasure in living, akin to the psychical content.

Under the use of heroin practically all of the sensations observed in the use of morphine are duplicated, but to a minor degree. There are, however, if the experiences related to me are to be accounted at all trustworthy, certain points of difference. Whether such arise in the early period of the use of heroin alone or are observable throughout, it is yet too early to say, although I am inclined to believe that later the differences in subjective variations are inappreciable.

Under heroin the sense of euphoria is not an exaltation of the cerebral functions, neither is it a forgetfulness of all external impressions, nor yet the joy of living in a world apart from this real world: it seems to be simply the loss of desire, a cessation of "craving;" and if the patient has been previously addicted to the use of morphine, heroin induces a physiological equivalent in giving contentment. To the healthy man the sensations of pleasure are not wanting. There may be marked relief from pain, but the delicious sense of pleasurable warmth and comfort that steals over the body is lacking to the same

[1] Revue de Médecine, October and November, 1900.

degree. The sense of coldness disappears, and the hot flashes observed with morphine may also be present; but it does not seem to be that vague glow that can in a moment revive a weak body and give it a new feeling of vigor. The sense of weakness experienced by the habitué does disappear, but it is imperceptible. I have not been able to obtain a history of the sudden access of mental and physical vigor that so often follows the use of morphine by the habitué, although some patients have said that heroin "has morphine skinned to death."

Lavallée states that but few individuals experience euphoria from heroin. My own experience is not so. Most have felt it, and even when given by the mouth—a distinct point of difference in the observations of Lavallée and my own. In one patient I can well remember that she was almost impressionless to any amount of morphine, being a "grand morphinomaniac," as the French call them, taking indifferently from 20 to 50 grains a day hypodermically, yet ¼ grain of heroin give her distinct euphoria—a new sensation, which she was loud in proclaiming had not been her joy for many years. For a time it seemed that I might be able to help her habit, but unfortunate domestic ties made former associationship inevitable, and she has disappeared from observation.

OBSERVATIONS. A few illustrative cases are here reported, some of which are distinctly out of the ordinary run. They are offered as fuel to the social as well as to the medical grist. These cases have been chosen more as types than as individuals. They illustrate failures as well as successes, and also show some of the factors which militate against the probability of cure in some instances.

Report of Cases.

CASE I.—H. M., aged thirty years; occupation, green-goods man. His early history is of interest. His father and mother were working-class people living in the crowded tenement-house districts of lower New York City. He went to public school, and at the age of fourteen or fifteen years obtained a position as lookout at the door of an opium joint. He soon learned how to smoke, and at the age of sixteen years was a confirmed smoker. He was an attendant in the joint for a couple of years, and then went on the vaudeville stage, doing a song-and-dance turn. He continued in this line for three or four years, but the work became too hard for him, and he drifted into the line of bunco-steering, at which he is said to have been a clever artist. He began using the syringe at this time, at first using 2 to 3 grains of morphine a day. For the past five or six years this dose has been increasing, so that at one time his average daily quantity varied from 60 to 90 grains. One day he took ½ ounce—120 grains. He invariably took his solution hot, heating a teaspoonful of water over an alcohol lamp and placing a cube of 4 to 5 grains at one time in the spoon. This was injected while still hot—just below the point of actual burning. In this manner he was able to get larger doses and thus obtain

a more continued action, as he explained, since large quantities of the drug were thrown out of solution beneath the skin, because the normal body heat reduced the temperature. It is very improbable that any differentiation of sensation could be experienced by the patient between doses over 60 grains a day; but there is no doubt, in my mind at least, that when doses of less than 60 grains were taken distinct sensations of distress could be appreciated.

When this patient came under treatment he was in a very bad condition. Sleep, even with enormous doses, was almost impossible. His appetite was very capricious, and rectal and bladder power were lost. Continued *fellatio* gave sexual satisfaction.

In treating him the psychical element of companionship seemed to be one of the strongest aids. Of his own accord, and with full liberty, he gradually diminished the dose to 15, 10, 8, 7, 6, 5, 4, 3, 2 grains a day, reaching a stage varying from 4 to 2 grains a day in about four weeks. At this point his suffering was very extreme, and an infinite amount of patience, tact, and ingenuity in devising lines of thought and inquiry were necessary to keep him at all contented. He was held on this dose for about two weeks, and had begun to gain control of himself, when an unfortunate family episode upset his self-control and resulted in a tragedy.

His greatest boast and pride had been that he was gradually conquering the hold of the drug for the sake of his wife and his home; and this psychical stimulus, although at best but a very sentimental one, was pushed to its fullest extent in the course of the treatment; and when he found, on coming home at an unexpected hour, his wife and her paramour in a compromising position, his already overtaxed nervous system gave way, and he promptly drew a pistol, shot at the retreating marauder, shot his wife non-fatally through the shoulder, and then placed the end of the barrel in his mouth and killed himself.

This case needs no comment. Its dramatic ending gives an inkling of the extreme state of mental unrest that was this patient's. Had this accident not occurred I believe it was possible and probable that the provisional cure of the patient might have resulted.

A somewhat similar case occurring in a man of somewhat higher social status resulted in a cure by the same methods.

By method—it might almost seem lack of method, it being only by the power of forceful and repeated suggestion—these patients were enabled to reduce the dosage of their own volition. I believe that for this class of ambulatory cases—those not confined to an institution—almost the only step that promises hope is that of implicit confidence in the patient and a mutual trust. If the patient backslides and confesses it, there is some hope that his confidence is being gained and that the remnant of self-respect is being kept alive. For these patients I insist that they keep a note-book of just how much morphine they take, recording the amount and the hour and minute it was taken, and what differences were to be noted in the sensations as the doses are being reduced. They are permitted the use of their own syringe, and the only obligation is that they take so much and record it.

It may seem trivial to record these observations, and the pessimist may greet them with a smile of incredulity; nothing is more natural, and similar doubts were aroused in my own mind, when an habitué—in fact, several—told me that the only reason why they never had any success in getting cured was that they were not trusted and permitted to do as they themselves wished. That they must work out their own salvation with fear and trembling is, I believe, a primary canon.

Case II.—H. S., aged thirty-nine years. This patient learned to smoke at the age of seventeen years, having been taught by an actress. For a short time he worked about a theatre in New York, and then went as an assistant to a tight-rope walker. Many ups and downs have occurred in his life, but for seventeen years at least he had smoked the pipe. About four years ago he came under my care, and in about one year a cure was effected. This patient is an accomplished cooker of opium pills, and can lie around a layout for hours, but has had no desire to touch the pipe during this interval of time. It is of interest to note that $\frac{1}{6}$ grain of heroin or of dionin gives this patient a sense of euphoria which, in his own vernacular, "has the pipe skinned to death."

Case III.—This third patient, D. W., aged fifty-one years, serves as a type of a number, a half-score of whom I have seen within the past year. He represents what may be called the substituted habitué, and is typical of what happens to those who pursue the downward path which has but one ending. Beginning as a smoker, he gradually acquired the morphine habit, first by inhalation in cigarettes, then taking it by the mouth, then by the hypodermic. About two years ago he came under treatment by one of the newer morphine derivatives. In the early months of his treatment it seemed that success was to be achieved, but he soon so thoroughly enjoyed his new substitute that he finally found out what it was, and is now a confirmed habitué of this newer morphine derivative.

Whereas for the laity I believe that this history is an exception, for opium habitués and for those who know of the newer drugs it will be inevitable that some will take them up for the simple reason that they provide a different stimulus and a new one.

Case IV.—C. W., a native of Pennsylvania—a woman, aged twenty-six years—affords an extremely interesting illustration of medico-legal import. This patient was of the periodical type. She would leave her home about twice a year, would come to New York, and for two months go on a debauch in which she drank and smoked opium, took morphine by the mouth, and frequented the Tenderloin both for pleasure and profit, although a woman in a comparatively upper walk in life.

After several years she became accustomed to the use of opium, and finally came to take morphine regularly by the mouth. The reason for her coming under medical observation was peculiar. She obtained a prescription for ten $\frac{1}{4}$-grain morphine sulphate tablets from a young and unsuspecting practitioner, altered his figures to read one hundred, and obtained from the druggist this number; but the pharmacist gave

her one hundred ¼-grain morphine tablets with $\frac{1}{200}$ grain atropine, and when she promptly swallowed ten she came under observation suffering from severe atropine poisoning.

This patient made a recovery from the poisoning, and under treatment for the morphinism has gone back to the pipe. This means one step in the cure of many patients, although it is true that most go the other way. In fact, among smokers it is often regarded that when one goes from the pipe to the "gun" they are going down hill.

VOLVULUS OF THE SMALL INTESTINE—ITS RELATIONS TO HERNIA. TORSION OF THE ENTIRE MESENTERY. REPORT AND RÉSUMÉ OF CASES.[1]

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Some years ago Leichtenstern found in about 1500 cases of intestinal obstruction that only 33, or a little over 2 per cent., were caused by volvulus.

In Gibson's recent article—"A Study of 1000 Operations for Acute Intestinal Obstruction and Gangrenous Hernia"—volvulus is given as the cause of obstruction in 12 per cent. of the cases, becoming fourth in the list of causes, hernia holding the first place, with 35 per cent., and intussusception and bands becoming second and third, each occurring in about 19 per cent. of cases; so volvulus is now recognized far more frequently than formerly as a cause of intestinal obstruction.

Definition. Volvulus is from the Latin word *volvere*, to roll. In surgery it means the rolling or turning of the intestine and mesentery in such a manner as to obstruct the lumen of the intestine, the circulation in the bloodvessels, or both.

For a long time volvulus was used synonymously with ileus, and meant almost any form of intestinal obstruction. In a thesis written in 1765, Grol states that volvulus is caused by erysipelas, inflammation, tumors, scirrhus, fecal impaction, enteroliths, worms, and intussusception.

Early in the last century Rokitansky described three forms of volvulus:

1. Rotation of the bowel on its own axis.
2. Rotation of a loop of bowel around its mesenteric axis.
3. The intertwining of two adjacent loops of bowel.

[1] Read by title at the meeting of the Association of Military Surgeons, at Washington, D. C., June 7, 1902.

ANATOMY, ETIOLOGY, AND PATHOLOGY. The mesentery is a fan-shaped double fold of peritoneum extending from the vertebral column to the convolutions of the jejunum and ileum, which it envelops, forming their peritoneal coat. The root of the mesentery is about six inches broad, extending obliquely from the left side of the second lumbar vertebra to the right sacro-iliac symphysis. Its length is about four inches from the vertebral attachment to the intestines, where it spreads out like a fan to include some nineteen feet of intestine. It contains between its folds the vessels and nerves of the small intestine. The shape of the mesentery, with its narrow pedicle or root and its broad periphery, would seem to make it an easy victim of rotation whenever the vermicular motion of the intestines attached to its broad end becomes unusually active, and the only surprise is that torsion of the mesentery is not more frequent. A *portion* of the mesentery may be involved, as in case of rotation of a coil of intestine, say fifteen inches long, the portion attached to that coil would undergo torsion; or the *entire* mesentery attached to nineteen feet of intestine may be twisted by rotation around its own axis, either from right to left or from left to right, making from half a turn (180 degrees) to two complete turns, as in a case reported by Delore, in which almost the entire ileum was twisted twice around its mesentery from right to left. Bassinot believes that the direction of rotation is more frequently from right to left, as the hands of a watch move; and this opinion seems plausible when we consider the oblique attachment of the root of the mesentery, the upper border bearing to the left and the lower border to the right, so that a weight or traction acting vertically on the upper border in line with the long axis of the body when erect would tend to pull it down on the left side while the lower border ascends. This motion continued would cause rotation from right to left, or as the hands of a clock move. But my statistics, while not numerous enough to be of much value, do not sustain this theory, as in 14 cases of torsion of the entire mesentery in which the direction was given, only 6 were from right to left and 8 were in the reverse direction. Taking all the cases together of torsion of the *entire* mesentery and of *parts* of the mesentery in which the direction of the turn is given, we have 24 cases, in 11 of which the direction is from right to left and in 13 the reverse.

Rotation of a segment of intestine on its longitudinal axis is rare, but it may be caused by bands, adhesions, or tumors. A tumor attached to the upper border of a horizontal portion of intestine would by gravity tend to fall below, bringing the upper border with it, rotating the tube on its axis, and possibly diminishing its lumen and obstructing its vessels. It is more common for a tumor to produce rotation of the mesentery, as in Case 4, Series II., reported by Briddon.

Volvulus may produce obstruction of the circulation or of the lumen

of the intestine; usually it does both. Torsion of the mesentery on its axis not only arrests the venous return from the intestines—which in turn reacts on the capillary and arterial circulation, causing, if complete, rapid death of nearly the entire small bowel, often preceded by hemorrhage both into the lumen of the bowel and into the peritoneal cavity; but usually by pressure of one or both of its tightly stretched borders it obstructs the lumen of the gut, and while this *may* block both ends of the tube it almost invariably affects the lower end, usually the ileum. Sometimes the pressure is so great as to cause ulceration at the point of pressure, or division of the coats of the bowel, as was stated by Captain Smyth in Case 7, Series II.

The lumen of the intestine may be occluded by pressure of one segment of bowel on another without materially affecting the mesentery. Probably many cases of "colic" are caused by the latter form of volvulus, and as the intestine rights itself the symptoms disappear.

All authorities agree that volvulus occurs much more frequently in the colon than in the small intestine. Of 121 cases cited by Gibson 73 were in the colon, 58 in the sigmoid flexure, and 15 in other parts of the colon; and only 36, less than one-third, were found in the small intestine. Leichtenstern found in 76 cases of volvulus, 45 in the sigmoid flexure, 23 in the ileum, and 8 in the jejunum and ileum combined. In my collection no cases of volvulus of the large intestine are included.

The causes commonly given are, first, *age*. The average age of Gibson's 121 cases—both large and small intestine—was forty-five years. In my list of 54 cases—small intestine only—the average age was forty-one years, and the greatest in any decade was 11, between fifty and sixty years. If we compare the average age of the cases in which hernia was associated with volvulus with those in which there was no hernia we are at once struck with the difference, in the former the average age being fifty-four years and in the latter thirty-six years. Volvulus may occur at any age—several have been reported in persons over seventy years; and Tissier and Mercier report a congenital case.

Second, *sex*. It seems to be somewhat more frequent in males. Gibson gives 67 males to 40 females, while the proportion in my list is 32 males to 27 females.

Third, *abnormally long mesentery*. A long mesentery, like the elongated pedicle of a tumor, predisposes to rotation. The mesentery may be congenitally long, or its length may be increased by traction on the bowels by means of fecal accumulations which especially affect the sigmoid flexure, adhesions, tumors, hernia, or general loss of flesh. There is no doubt that volvulus of the mesentery proper may and does occur without elongation. With the mesentery elongated like a

pedicle, a slight force may cause the intestines to revolve and twist the mesentery on its axis. This force may be violent exercise, unusual peristaltic action as a result of indigestion, or traumatism, as in cases reported by Turner, Hawkins, Staveley, and Giddings.

Hernia is not infrequently associated with and is the cause of volvulus. Volvulus may affect the intestine and the small portion of mesentery in a hernia sac, or it may be wholly within the abdominal cavity and involve the entire mesentery, while only a short coil of intestine is found in an external hernia. Volvulus may be caused by traction of a coil of intestine attached to the highest part of the mesentery dragging it down so that it becomes the lowest part, and thus makes a half revolution (180 degrees) on its axis. Such seems to have been the condition in the following case:

CASE 21. *Volvulus with hernia; death in less than twenty-four hours.* —H. W., negro, aged thirty-five years; was taken sick January 21, 1902, at night, with pain, cramps in the bowels, and vomiting. He had had a right inguinal hernia several years, and this had come down, and he thought the trouble was caused by it, as he could not reduce it. Next morning he went to work as a laborer, but felt so weak on account of the pain in the bowels and vomiting that he had to stop, and was brought to the Emergency Hospital about 12 o'clock, January 22d. A hernia in the right side of the scrotum was reduced by taxis without difficulty, and he experienced some relief; but soon after it was noticed that his pulse had not improved—it was 100 and very weak and thready, scarcely perceptible at the wrist—and he continued to vomit. When I saw him at 4 P.M., about twenty hours after he was taken sick, he was in collapse; pulse as given; temperature subnormal (97.4° F.); voice so weak that it could scarcely be heard; little pain, but that was in the bowels. He began to vomit while I was looking at him, and vomited over 1000 c.c. of chylous-looking fluid, and immediately died.

Post-mortem Examination. On opening the abdomen over 1000 c.c. of dark, bloody fluid were found in the peritoneal cavity. The intestines which presented were black and leathery and offensive. The bulk of the gangrenous intestines lay on the left side. Examination showed a twist of the mesentery from right to left through an arc of 180 degrees, including the superior mesenteric artery and vein. The vein contained large thrombi, and the edge of the mesentery compressed a point in the small intestine about eight feet from the pylorus, enough to leave an indentation. The cæcum with appendix were drawn tightly on the stretch toward the left side, and both were gangrenous. The small intestine from the point indented by the edge of the mesentery to a point just above the cæcum, a little over thirteen feet, was gangrenous, black, and leathery. No perforation was found. The rest of the intestine above and below was in good condition, only considerably congested. The intestine contained a quantity of bloody fluid similar to that in the peritoneal cavity. It is possible that the hernia, which was a coil of the upper ileum or jejunum, started the mesentery to rotating by traction.

Sometimes the volvulus in the abdomen is kept in twist by the fixation of the coil in the hernial sac. Such was the explanation of several cases, especially those reported by Knaggs.

Symptoms and Diagnosis. The symptoms of volvulus of the small intestine are those of acute intestinal obstruction, coming on suddenly, often when the patient is seemingly in perfect health. Pain of a severe, colicky character, usually in the abdomen, although in one case it was most severe in the back (see Case 7); vomiting; rapid, feeble pulse; subnormal temperature; obstinate constipation, purgatives having no effect; distention of the abdomen, and great prostration. Vomiting is usually present, but in the histories given it was reported absent in five cases—8 per cent. Many times the vomitus becomes stercoraceous, proving that although the intestine may be obstructed below it may yet remain pervious above. The pulse may be little changed for the first six or eight hours; after that it becomes feeble, thready, and 100 to 160 a minute. The temperature is unreliable; it may be normal for a while, then somewhat elevated—100° to 101° F.; but later it is often subnormal. The abdomen is usually distended and tympanitic. In the early stages, before tympanites becomes general, a circumscribed area of tympanites in the hypogastric region, due to distention with gas of the portion of intestine involved, is a valuable symptom. There is usually tenderness over certain parts of the abdomen, and sometimes a swelling, band, or ridge can be made out by palpation. Occasionally a definite mass or tumor can be felt within the abdomen.

Rectal or vaginal examination will sometimes disclose a boggy mass in the rectovesical or rectovaginal pouch. This point has been emphasized by Major Williams, of the Indian Medical Service (Case 20), and mentioned by Homans, Littlewood, and others. While a bloody effusion often occurs both in the peritoneal cavity and in the intestine affected, blood is seldom vomited or passed at stool.

The diagnosis may be difficult as to volvulus, but it is easy to determine the existence of intestinal obstruction, and that is enough to indicate the proper line of treatment.

The most unfortunate mistakes are liable to be made when an unseen volvulus is associated with a visible hernia. A patient with hernia may have symptoms of obstruction or strangulation. The hernial sac is opened and a congested coil of intestine is reduced; but if a volvulus exists in the abdomen, as it too often does, the symptoms are not removed, and death relieves the patient unless the surgeon does by another operation. My case is a good example of this, in which the patient's life was saved by a stroke of good luck.

Case 39. *Inguinal hernia with volvulus in the abdomen; resection of intestine; recovery.*—W. G., aged sixty years; male negro; had had a right inguinal hernia for many years, and was operated on for strangu-

lation ten years ago. January 8, 1900, at 10.30 A.M., while lifting a cake of ice, the hernia came down in spite of his truss, and he was unable to reduce it. He had severe pain in the abdomen and vomiting. Patient was operated on at the Emergency Hospital at 3 P.M., four and a half hours after the symptoms began, under chloroform. The tumor was about the size of an adult head, and very tense and dull on percussion over the lower part. The sac, which was anatomically congenital, was opened and found to contain the cæcum, part of the ileum, and a large mass of omentum, which was adherent to the bottom of the sac. The small intestine was slightly congested and was reduced, when, to my surprise, a coil of small intestine, black and gangrenous, came into view. It was up to this moment in the abdominal cavity and not in the hernial sac. The coil was pulled down until a sound part was reached, and twenty-eight inches were resected and the ends united with a Murphy button. The mesentery was swollen and œdematous. The omentum was ligated, cut away from the sac, and returned to the abdominal cavity, and Bassini's operation for the radical cure of hernia was performed, the wound being closed without drainage. The patient recovered without incident, passing the Murphy button on the fourteenth day, and was discharged on the eighteenth day after the operation. When seen more than a year later, he was perfectly well.

PROGNOSIS. In my list of 61 cases there were 51 operations, with 21 recoveries—a mortality of 60 per cent. Separating the two classes, we find 17 operations for twisting of the entire mesentery, with only 4 recoveries—a mortality of 76 per cent. Delbet's second case, which died of pneumonia eleven days after the operation, is included in the fatal cases, although in a sense it may be regarded as a success, as the patient died from another cause than the operation. There were 34 operations for volvulus of *part* of the mesentery, with 17 recoveries—a mortality of 50 per cent. Gibson reports 36 cases of volvulus of the *small* intestine operated on, with 25 deaths—a mortality of 70 per cent.; and of the colon, 73 cases, with 34 deaths—a mortality of 50 per cent. The high mortality in the operations for volvulus *entire* is due to three causes: First, *the more serious nature* of a condition which strangulates almost the entire small intestine, injures the sympathetic plexus, and perhaps produces a rapidly fatal toxæmia —less than twenty-four hours in my case; second, *delay in operating*: of the 14 cases in which the time was given which elapsed between the onset of the symptoms and the operation it ranged from ten hours to nine days, all the successful cases being operated on in less than forty-eight hours, except Major Brown's case, in which the symptoms were at first not acute; and, third, the *difficulty of recognizing the true condition*, in order to act intelligently—four operators candidly confessed their inability to do so after opening the abdomen, and the patients died without relief, the true condition being at last disclosed by a necropsy.

TREATMENT. G. H. Hunter advises the treatment of volvulus by rotation of the body of the patient around its long axis in the opposite direction to the volvulus, ascertaining this by the lack of pain when the patient turns in the proper direction. With the symptoms of acute obstruction usually seen in volvulus there should be no hesitation in performing laparotomy at the earliest possible moment. The abdomen should be opened near the median line, as a rule, through the right rectus muscle, in order to be more convenient to the root of the mesentery for the purpose of making an examination, unless there is a tumor perceptible, when it is best to make the incision over the tumor.

The escape of bloody fluid on opening the peritoneum is often seen. The intestines are usually distended, congested, and often brown or black in color. Examination of the coats of the intestines and the mesentery shows enlarged, swollen veins. Search should be made for other causes of obstruction—such as hernia, tumors, intussusception, bands—and then the mesentery should be examined thoroughly, removing, if necessary, all the coils of the small intestine from the abdomen in order to do so. The difficulty in finding the trouble can be better appreciated by reading the experience of Major Debrie and of Kirmisson, Delbet, and Delore. Kirmisson frankly confesses that he took the twist of the mesentery for the ligament of Treitz, and did not recognize the true condition. Delbet failed to recognize the condition in his first case, and was under the impression that it might be a retroperitoneal hernia, as two segments of intestine—one collapsed, the other distended—passed behind a tense fold of peritoneum. He made an anastomosis between these two parts of the bowel, and found at the necropsy that he had united the first part of the jejunum with the last coil of the ileum.

If the intestine is gangrenous it should be removed and an end-to-end anastomosis made unless the extent exceed ten feet; excision of a greater length, as shown by experiment and experience, is almost inevitably fatal. Gibson stated in 1900 that there was only one record of successful resection of the small intestine for volvulus—that of 127 centimetres (4¼ feet) by Riedel. In my list of 51 operations there were 3 resections, with recovery. In one of them—Dreesman's case—2.15 metres (7 feet) were removed.

In operating on hernia with symptoms of obstruction the surgeon should always bear in mind the possibility of the existence of volvulus in the abdomen. The condition and relation of the contents of the hernial sac—as a swollen and congested loop of bowel, with insufficient constriction at the rings to account for it, or an intestine of unusual appearance which could not explain the symptoms of obstruction—should excite suspicion of this complication. In every case the sur-

geon should satisfy himself on this point by pulling down the coils of intestine, or, if necessary, by opening the abdomen.

The contents of every case of strangulated hernia should be carefully inspected—that is, under no circumstances should a *strangulated* hernia be reduced by the blind method of taxis unless there are good reasons for not operating.

Following is an abstract of 61 cases—by no means a complete list—taken from the literature. This list is divided into two classes: I. Those termed "entire"—21 in number—in which the *entire* mesentery is twisted, affecting almost the whole of the small intestine; and II., those termed "in part"—40 in number—in which only a *portion* of the mesentery is involved, and therefore only a small portion of the intestine is affected.

I. Volvulus of the Entire Mesentery.

Case 1. *Volvulus of the entire mesentery; death.*—H. Rokitansky, in 1837, reported a case of hernia complicated with volvulus in a woman, aged seventy-one years. She was admitted to the hospital in December, 1830, with symptoms of strangulated hernia. The hernia was reduced by taxis, but the patient died ten days later.

Necropsy. There was peritonitis and the mesentery folded and completely twisted on itself, forming a kind of axis 4½ inches long and 1½ inches thick, around which the small intestines were rolled. The small intestine descended from the duodenum to the right iliac fossa and twisted upon itself in front of the vertebral column, making two circuits around the axis formed by the mesentery. The intestine was discolored, soft, friable, and perforated about two inches from the ileo-cæcal valve.

Case 2 (Rokitansky). *Death.*—A woman, aged seventy-two years, in 1833, suffered with fever, nausea, pain, and tympanites of the stomach; fecal vomiting and death in three days.

Necropsy. Peritonitis. Very long mesentery, which was twisted one and a half times around its axis, the ileum occupying the upper part of the abdomen, while the jejunum occupied the left umbilical region. The species of cord formed by the mesentery (twisted) pressed the two extremities of the small intestine against the left side of the vertebral column—the ileum, which from one and a half feet from the cæcum extended downward and toward the right side, while the upper part of the jejunum passed under the mesentery in an opposite direction—upward and from right to left. Intestine deeply indented, as if cut by a ligature where pressed by the mesentery. Gangrene.

Case 3 (Rokitansky). *Death.*—A woman, aged seventy-two years, died in 1839 after suffering from abdominal pain and fecal vomiting.

Necropsy. Stomach and intestine distended with gas and yellowish liquid. The mesentery was very much elongated, and twisted on itself in such a way that the ileum was situated in the upper and the jejunum in the lower part of the abdomen, the mass of intestines occupying the left and middle region of the abdomen.

CASE 4 (Rokitansky). *Death.*—A woman, aged seventy-one years, who had suffered twelve years with femoral hernia, died in 1839 from internal strangulation.

Necropsy. Distended abdomen; intestine containing gas and yellowish liquid; peritonitis. Mesentery attached to ileum was very long and folded and twisted on itself, forming an axis 4½ inches long and 1½ inches thick, around which the small intestine was wound.

CASE 5. *Operation; death.*—In September, 1885, Major Mignon, of the French army, saw a man, aged twenty-eight years, who had been taken suddenly ill with vomiting and severe pain in the abdomen. These symptoms continued during the night, and he was sent to the Val du Grace Hospital next day with the diagnosis of peritonitis. Twenty-four hours after the symptoms began the patient was hollow-eyed, with cold extremities; pulse 150, and feeble; temperature, 39° C.; abdomen distended only in the lower half; nausea and vomiting. Frequent desire to go to stool, but without effect. Laparotomy about thirty-six hours after the onset of the trouble, giving exit to 1500 c.c. of yellow fluid; the intestines were distended and purple. The mesentery of the small intestine was found twisted once on itself from *left* to *right* and from below upward, making a cord about one inch thick. This was untwisted, and the patient passed 200 grammes of liquid fecal matter, but died five hours after operation.

CASE 6. *Operation; recovery.*—Routier's case is as follows: A woman was taken suddenly ill in the night of January 8, 1890, with severe pain in the region of the transverse colon. Next day, the 9th, vomiting began and became fecal. There was no passage of stool or gas from the bowels. On the 10th fecal vomiting continued; temperature was 37.6° C.; pulse small, thready, and very rapid. The abdomen was large and somewhat tympanitic. To the left and on a level with the umbilicus was a painful region about the size of the palm of the hand; pain increased by pressure and percussion, and *something* other than muscular contraction was felt in this region. Internal strangulation was diagnosed and laparotomy performed on the evening of the 10th, about thirty-four hours after the attack began. The abdomen was opened below the navel and a quantity of turbid fluid escaped. The intestines were distended and congested, while other parts of the same intestine were collapsed and pale. Introducing the finger, all seemed free downward and to the right; but to the left a tense, hard body was felt, about 15 centimetres in diameter. Pulling on the distended intestine it was found to run down toward the right hypochondrium, and 80 centimetres were reeled off before resistance was felt. Exposing the part to sight, the intestine seemed to enter an opening like a hernial ring. Gentle traction on the intestine drew out about a metre, when the sense of resistance suddenly ceased, the ring disappeared, and the mass of intestines assumed their normal relations. The circulation seemed restored except that certain parts remained dark. The abdomen was closed, and the patient recovered after having a pneumonia.

CASE 7. *Operation; recovery.*—Major W. R. Brown, Indian Medical Service, operated December 21, 1892, on a coolie, aged fifty years, who had been taken with pain in the belly on December 16, soon after eating eight or nine plantains. The bowels moved slightly that day, but not at all during the next five days, in spite of purgatives. The pain continued, and the abdomen increased in size and became tym-

panitic; pain more on the right side. (Nothing was said about vomiting.) Pulse 76, but feeble. Laparotomy through the left rectus below the navel, afterward extended upward. The small intestines were distended and their bloodvessels much congested. No obstruction could be found, so the whole of the small intestine was taken from the abdomen and surrounded with warm cloths. The cæcum was then seen to lie to the *left* of the middle line, and on examining the mesentery it was found to be twisted on itself from *left* to *right*, and was much congested. The coils of small intestine were taken up in the four hands (operator's and assistant's) and rotated in the opposite direction. The cæcum returned to its normal position on the right, and immediately the noise of gas and fluid passing through the bowel was heard, and the bowels moved soon after. Wound closed with drainage tube left in. The patient made a good recovery and was discharged January 23, 1893, and was shown to a medical society February 24, 1893.

In the discussion Captain Smyth referred to the difficulty of recognizing the condition after the abdomen had been opened, and mentioned a case in which the abdomen had been closed without recognizing the trouble, the true condition being brought out at a necropsy. He had seen several cases on the post-mortem table. He stated that the actual seat of obstruction is to be found in the ileum, about six inches from the cæcum, where the gut is so compressed that the mucous membrane is sometimes divided, as in a case he had seen.

CASE 8. *Operation; death.*—Monod operated, April 2, 1893, on a girl, aged fifteen years, who was taken six days before with symptoms of intestinal obstruction. First, obstinate constipation (constipation was habitual), resisting the effects of purgatives; then distention of the abdomen, tympanites being greater in the centre than the periphery, as if the small intestine was distended, while the large intestine was not. There was no vomiting; the pulse was a little rapid, but good; temperature, 38° C. The patient complained most of severe pains in the region of the kidneys. On opening the abdomen the intestines presented as an enormous rounded mass, stretched almost to bursting, of a black-greenish color, resembling a cyst. Fluid was found in the peritoneal cavity. The enormously distended intestines were punctured and relieved of gas. The small intestines were found twisted on the mesentery from *left* to *right*, involving nearly all the small intestine. The intestine was untwisted, but retained its black-greenish color (gangrenous), and death occurred the next day.

CASE 9. *Operation; death.*—Reynier reported in 1898 the case of a female operated on by his assistant some time before for symptoms of intestinal obstruction. A torsion of the mesentery was found, and it was necessary to remove the entire mass of intestines from the abdomen before they could be untwisted. The patient died.

CASE 10. *Operation; death.*—Reynier's second case was a woman, aged fifty years, operated on by him in 1896, seven days after the attack began, with distention, tympanites, and vomiting. He thought at first it was a case of occlusion of the large intestine by a neoplasm. On opening the abdomen the small intestines were found distended, and, searching for the cause of obstruction, a band was found in the right iliac fossa, under which the entire mass of intestines was engaged. He at first thought it was a retroperitoneal hernia, but on drawing on

the band he recognized a twist of the mesentery from *right* to *left*. It was necessary to deliver the intestines from the abdomen in order to untwist them. The veins of the intestines were gorged with black blood, and the intestines were in a gangrenous condition. Death was the result.

Case 11. *Operation; death.*—Kirmisson operated, March 14, 1898, on a boy, aged seven and a half years, who was taken on March 2 with constipation, pain, and vomiting. He got better, and was taken again, March 10, with the same symptoms, and next day there was fecal vomiting. There was no swelling or tympanites of the abdomen, but on the fourteenth day he was much worse, with weak, rapid pulse. The abdomen was opened, the intestines found contracted, the mesenteric veins distended, and a twist of the mesentery was taken for the ligament of Treitz, the true condition not being recognized, and the abdomen was closed. Death resulted.

The necropsy showed a complete torsion of the mesentery from *left* to *right*—about 360 degrees—easily untwisted by turning it in the opposite direction.

Case 12. *Operation; recovery.*—F. J. Shepherd operated, May 9, 1898, on a man, aged twenty-seven years, who had been taken suddenly ill two days before with severe pain just below the navel, and vomiting, which continued. Purgatives had no effect. On admission, pulse 140, temperature 97½° F.; abdomen somewhat distended and tender. Scar of appendectomy done two years before, with a small hernial protrusion, was seen. Laparotomy gave exit to a quantity of reddish serum, and dark-colored coils of intestine presented. Two bands were divided —evidently from the old appendicitis—and the *whole* mesentery was found twisted from *left* to *right*. It was untwisted, the wound closed, with drainage, and the patient recovered.

Case 13. *Operation; death.*—Delbet reported, June 15, 1898, two cases of torsion of the mesentery. Case 1 was a woman, operated on nine days after the first symptoms of intestinal obstruction. She was very weak, with a greatly distended abdomen, which suggested volvulus of the sigmoid flexure; but this was found collapsed, likewise the cæcum. The last coil of small intestine was empty, and on tracing it upward it suddenly bent in and disappeared behind a tense peritoneal fold with a prominent border, upon which the intestine curved from right to left and from above downward. On following it with the finger the impression was given of entering a cavity, which suggested a retroperitoneal hernia. On lifting up the mass of distended intestines a coil of distended intestine was seen by the side of the last coil of collapsed intestine, both engaged behind the sharp border of the peritoneal fold—a circumstance which strongly suggested retroperitoneal hernia. There was apparently a sharp peritoneal fold bounding an opening in which were engaged two coils of intestine—the one distended, the other empty. Traction on the superior, distended, end, in order to reduce the hernia, permitted a slight lengthening, but failed to change the appearance. Traction on the lower, empty coil had no effect. The finger introduced behind the band showed that it was not a ring, and the strangulation seemed due rather to a bend than a constriction. It was impossible to understand the cause which prevented reduction. The coil seemed fixed in the depths. Not understanding the condition, and the state of the patient not permitting further manipulation, an

anastomosis was made between the collapsed and distended coils. The patient died some hours later. The necropsy showed that the anastomosis had been made between two extreme coils of the small intestine —the first coil of the jejunum and the last coil of the ileum. It was finally ascertained to be a torsion of the entire small intestine (mesentery) a little more than a fourth of the way around, as the hands of a watch move. Matters were easily corrected by torsion in the opposite direction.

CASE 14. *Operation; death from pneumonia.*—Delbet's second case was a man, aged sixty-nine years, who was taken suddenly ill, January 30, with violent abdominal pain, especially in the right side; then vomiting and tympanites of the abdomen. Temperature, 37.4° C.; pulse, 100. Laparotomy was done in the evening, about ten hours after the attack began, making the incision below the navel. A quantity of fluid escaped, having the color of that which is seen in strangulated hernia. The small intestine was distended and dark red in color. After enlarging the incision and allowing part of the intestine to escape, the last coil of the ileum was seen collapsed, twisted, and fixed under a peritoneal fold, together with another small coil, red and strongly distended. The ileum, stretched between the cæcum and the peritoneal fold, was immovable, and flat against the posterior wall of the abdomen. The other coil was movable in the middle, one end engaged with the ileum behind the peritoneal fold, and could be easily moved, while its other end, which passed beneath another fold of peritoneum, was fixed. Between the two ends of this distended intestine the mesentery appeared visibly twisted. It was evidently a torsion of the entire mesentery from *right* to *left*. Evisceration was done at once, and the enormous mass of distended intestines was wrapped in hot cloths and lifted up to stretch the mesentery, which was then untwisted by a motion from above downward and from left to right, making a turn and a quarter before the intestines assumed their normal position. The wound was closed, and the patient's condition was good—pulse 90 and temperature 36.8° C.; but bronchopneumonia set in two days later, affected both lungs, and death occurred eleven days after the operation from pneumonia.

CASE 15. *Operation; death.*—John Homans reports in the *Boston Medical and Surgical Journal*, September 29, 1898, page 315, a case of complete torsion of the whole of the small intestine. He said it was the first case he had ever seen, and had heard of only one case since.

A female, aged seven years, was taken, March 24, with pain in the stomach, bowels did not act, pain continued next day, and she vomited. On the 26th she vomited again and kept her bed. There was distention, tympanites, and tenderness at the epigastrium. A band could be felt in the left inguinal region, irregular in shape, and a hard mass was felt with the finger in the rectum. Diagnosis: intestinal obstruction, probably intussusception; and laparotomy in the linea alba, March 29th. Dark-colored fluid escaped on opening the peritoneum, and the small intestine, of a dark purple color and distended, protruded. The entire small intestine was found twisted from *right* to *left* on its mesenteric root. A diverticulum (Meckel's) was found attached. The mesentery was untwisted and the intestines aspirated, removing some gas and liquid fecal matter. They were returned with difficulty and the wound closed, with drainage. Vomiting continued after the operation,

and death occurred at the end of twenty-four hours. Necropsy showed acute peritonitis and patches of gangrene on the intestine.

CASE 16. *Operation; death.*—In March, 1899, Delore operated on a man, aged fifty-eight years, who had been taken, four days before, with gradual symptoms of intestinal obstruction, constipation, and tenderness of the abdomen, but he continued at work; then vomiting, becoming fecal, set in, and he was sent to the Hotel Dieu. On the day of the operation the pulse was 120 and temperature 38.6° C. On opening the abdomen turbid fluid escaped. The small intestine was much congested and distended. There was peritonitis, the intestines were fixed, and it was impossible to trace the ileum to the cæcum. It did not seem to be retrosigmoid or retrocæcal hernia. Some bands were found and divided, but they did not relieve, and the wound was closed without finding the cause of the obstruction. The patient died the next day.

The necropsy showed almost the entire ileum twisted twice around its mesentery, as the hands of a watch, from right to left, and the parts were in a condition of gangrene.

CASE 17. *Operation; death.*—Major Debrie, of the French army, operated, January 12, 1900, on a soldier who was taken on the 10th with general colicky pains in the abdomen, great weakness, and constant attempts to vomit. No stool for forty-eight hours. Temperature had been 38 2° C.; pulse rapid and feeble. On the day of the operation, temperature, 37.4° C.; pulse, 106; vomiting bilious, but not fecal. Abdomen very much distended and tympanitic. Thinking it might be appendicitis, chloroform was given and the abdomen was opened in the right iliac fossa. A red, turbid liquid escaped, and the intestines were so distended as to be kept in with great difficulty. The appendix was normal, and the patient's condition required arrest of the operation. The wound was partly closed, leaving in a gauze drain. Next day (13th), pulse, 120; temperature, 37.6° C.; no passage from bowels of stool or gas; patient more quiet. On the 14th patient passed some gas; nausea, but no vomiting. Death on the 15th.

Necropsy. The mesentery was found twisted on its axis from *left* to *right*, compressing the ileum two inches from the cæcum at one point, and completely cutting off its communication with the cæcum, and again in the upper part of the ileum, about three-quarters of the ileum being cut off from the rest of the intestine. The intestine above was distended; that included in the mesenteric torsion was dark colored and gangrenous.

CASE 18. *Operation; death.*—Morestin operated, March 22, 1900, on a man, aged forty-four years, who had been taken suddenly ill the day before with severe pain in the abdomen, vomiting, and obstinate constipation. At the time of the operation the temperature was normal, pulse 110, and the abdomen distended and tympanitic, especially in the subumbilical region. The intestines were much distended, and, as nothing definite could be found, evisceration was done, when a twist of the entire mesentery from *left* to *right* was seen. It was untwisted by rotating it from right to left, relieving the obstruction, as shown by the cæcum filling with gas. The wound was closed, but death occurred six hours later.

CASE 19. *Operation; resection; death.*—Küster operated, May 14, 1900, on a man, aged fifty years, and found rotation of almost the

entire small intestine around the root of the mesentery. It was untwisted and a segment of gangrenous intestine was resected. Death resulted.

CASE 20. *Operation; recovery.*—Major C. L. Williams, of the Indian Medical Service, operated, in February, 1901, on a male coolie, aged about thirty years, who had been sick just twenty-one hours with abdominal pain coming on suddenly in the night. A boggy mass was felt in the rectovesical space by means of the finger in the rectum. The mesentery had made one-half turn (180 degrees) from *left* to *right*, and was fairly easily untwisted. Recovery followed.

CASE 21.—See page 802.

II. (*A*) VOLVULUS IN PART.

CASE 1. *Operation; recovery; return of symptoms; second operation; recovery.*—A man, aged thirty-one years, was operated on at Basle, May 6, 1887, for symptoms of acute intestinal obstruction which came on two days before. On admission, patient was collapsed, cyanotic, pupils dilated, pulse small, abdomen slightly distended, and between the ensiform cartilage and navel a tender *swelling* could be felt.

Laparotomy over this swelling showed a volvulus of the small intestine, one-half turn (180 degrees) of the mesentery. It was untwisted, and two abrasions were seen at the point of torsion.

The patient recovered, but returned on account of constipation, pain in the abdomen, and vomiting, and a second laparotomy was done in the scar of the old one. The great omentum was adherent to the wound of the abdominal wall, and a foot of the mesentery was found attached by a band to the abdominal wall, producing some kinking. The adhesions were dissected loose, the abdomen closed, and the patient recovered.

Sublimate solution, 1 : 5000, was used in the first operation to disinfect the peritoneal cavity.

CASE 2. *Operation; death.*—J. C. Warren operated, August 8, 1887, on a man, aged fifty-two years, who had suffered at times from colic for three or four years. About three weeks before operation he was taken with pain in the epigastrium and back; bowels at first regular, then loose; *no vomiting at any time.* August 8th he became worse, with rapid pulse and great pain about the navel. There was general distention, but a deep-seated, resistant *tumor* as large as an infant's head could be felt near the navel. Median incision over this tumor showed it to be a twisted coil of small intestine, about nine or ten inches long, about the beginning of the ileum. Considerable bloody fluid escaped from the abdomen. The volvulus was untwisted with some difficulty and the wound closed. Death next day.

Necropsy. Incipient peritonitis; mesentery greatly thickened, the veins thrombosed, but bowel in good condition.

CASE 3. *Appendix involved in the torsion; operation; recovery.*—J. Nicolaysen, of Christiania, operated, September 30, 1889, on a man, aged twenty-seven years, who was taken sick on the 25th (five days before), with severe pain in the lower part of the abdomen. The pain left after a short time and came on again on the 29th, with great severity, below and to the left of the umbilicus. There was vomiting, and the abdomen was tensely contracted and tender, especially in the

right iliac region, in which a *tumor-like* resistance was felt. Pulse, 50 to 60; respiration, 30. On opening the abdomen below the navel bloody fluid escaped, and a distended, discolored coil of small intestine appeared, twisted from *left* to *right* about 180 degrees, with the vermiform appendix drawn with it, and forming a tense cord about the twisted point. By turning the coil in the opposite direction the strangulation was relieved, and the appendix returned to its normal position. The appendix was removed and the abdomen closed. Recovery followed.

Within a year following this patient had two attacks of pain i. the bowels, vomiting, and obstruction of the bowels, from which he recovered with the aid of medicinal treatment.

CASE 4. *Torsion of the mesentery caused by a tumor of the mesentery.*—Charles K. Briddon operated, October 13, 1892, on a girl, aged fifteen years, sick four days. She was taken suddenly with violent abdominal pain and vomiting, which kept up four days. No bowel movement for seven days. Abdomen tympanitic, moderately distended, and tender. Dulness on the right side. Pulse, 102; temperature, 100° F.

Abdomen opened on the right side. Brownish, discolored serum escaped, and a "large coil of moderately small intestine presented, which was of a dark purplish maroon color, and on separating this from other coils a bright yellow tumor came into view, measuring nine inches in circumference." This was found to be a sessile lipoma growing in the mesentery and encroaching on the surface of the bowel for about three-quarters of an inch. There was a twist of the mesentery which appeared to have been caused by axial rotation of the mass. The tumor was enucleated, and the patient recovered.

CASE 5. *Traumatic volvulus; operation; recovery.*—G. R. Turner reported, October 24, 1892, the case of a boy, aged seven years, who fell some twelve feet into the mud, striking against the pole of a boat. Collapse soon followed, with vomiting; then restlessness, pain, and tenderness in the right iliac fossa. The vomited matter became fecal. The abdomen was opened twenty-four hours after the accident. A tangled mass of intestines (ileum) was to the left of the middle line, and when this was unravelled two collapsed parts, a foot and two feet in length and separated from one another by about four feet of intervening intestine, were found. The collapsed gut at either end passed abruptly into the healthy intestine. Mr. Turner regarded it as a case of volvulus caused by injury. Uninterrupted recovery followed.

CASE 6. *Traumatic volvulus; death.*—Dr. Hawkins mentioned the case of a woman who died with symptoms of acute intestinal obstruction after a slight blow on the abdomen, and the necropsy showed a figure-of-eight twist of the gut behind the umbilicus, which unravelled itself as soon as exposed.

CASE 7. *Traumatic volvulus; death.*—Mr. Staveley related the case of a child, aged five years, on whom a slight blow had been struck on the abdomen, followed by symptoms of acute intestinal obstruction and death within twenty-four hours. Necropsy showed a volvulus situated thirty inches from the pylorus.

CASE 8. *Volvulus; operation; recovery.*—(Reported by Morris.) Mr. Gould operated, October 2, 1894, on a woman, aged twenty-five years, taken September 29th, after eating lobster, with vomiting and severe

pain in the abdomen; these symptoms continued. The abdomen was slightly distended and tender. Resonance over the front and slight dulness in the left flank. No passage from the bowels since September 29. Temperature, 96° F.; pulse, 120; fecal vomiting of a reddish-yellow color. Abdomen opened below the navel. A volvulus of the small intestine was found, the coils being congested and purple. It was untwisted, and the patient recovered and was discharged October 23d.

Cases 9 and 10. *Volvulus; operation; recovery.*—R. C. Kirkpatrick operated on two cases: (*a*) Operation, November 19, 1894, on woman, aged thirty years, sick three days with pain and vomiting. For a week previous she had cramps. There was constipation; abdomen was tense, slightly distended, and tender to pressure. Temperature, 100° F.; pulse, 78. A volvulus of three feet of small intestine was found, untwisted, and recovery followed. (*b*) Man, aged nineteen years, operated on April 21, 1894. He was taken sick the same day, with swelling of the abdomen, pain, symptoms of collapse; no vomiting. Operated on in the evening. No peritonitis. A volvulus of eight inches of small intestine was found, with a deep constriction at each end. It was untwisted, and recovery followed.

Case 11. *Volvulus caused by straining; resection; death.*—C. B. Lyman operated, October 31, 1895, on a woman, aged thirty years, who was taken sick the day before after doing some heavy lifting. There was pain in the bowels, constipation, and vomiting. The abdomen was tender, and a mass could be felt below and to the right of the navel. At the time of operation—about thirty hours after the attack came on—the pulse was 130, thready, and irregular; the extremities cold. A median incision was made below the navel, when a mass of intestine, black in color, presented. An attempt to untwist it failed, and twenty-seven inches were resected and the ends united by means of a Murphy button. Death occurred before morning. Necropsy showed that a coil of ileum had been twisted, the lower end of the loop being three inches from the cæcum.

Case 12. *Traumatic volvulus; operation; recovery.*—W. P. Giddings operated, February 5, 1899, on a boy, aged fifteen years, who had a fall three days before, and was seized one hour later with abdominal pain, obstipation, and vomiting. The day of operation the abdomen was distended, tympanitic, and tender; pulse, 108, thready; temperature, 97.5° F. On opening the abdomen about 1000 c.c. of bloody fluid poured out; beginning peritonitis was evident. After removing one-half of the small intestine the twist in the mesentery was found and untwisted. The abdomen was closed without drainage, and recovery followed.

Case 13. *Volvulus; operation; recovery.*—J. T. J. Morrison reports, in 1897, the case of a fat woman, aged fifty-three years, taken three days before the operation with severe pain in the bowels, obstipation, and vomiting, which became stercoraceous. No hernia.

On opening the abdomen a large quantity of offensive bloody fluid escaped, and a greatly distended coil of small intestine appeared. This loop was about sixteen inches long, seemed to be the ileum, and was twisted around its mesenteric axis from *left* to *right*. The bowel was deeply congested and ecchymosed, but it was untwisted and returned, the abdominal cavity mopped out, and the wound closed without drainage. Recovery followed.

CASE 14. *Congenital volvulus; perforation of the intestine above the obstruction: sigmoid anus; death.*—L. Tissier and R. Mercier reported, in 1897, the case of a female infant, perfectly developed, born September 28th, and who, two days later, became restless, refused to nurse, and began to vomit. The abdomen became distended. Temperature, 36.2° C. Patulous anus; but it was thought that the sigmoid was undeveloped, and operation for artificial anus in the left iliac region was made October 2d. On opening the abdomen a mass of small intestines with a large mesenteric pedicle came out. They were quite red and distended with gas, but contained no meconium. The patient died October 5th, the vomiting having persisted.

Necropsy. General peritonitis, with intestinal contents in the peritoneal cavity. The entire large intestine was empty and about the size (less) of an adult ureter; and 25 cm. from the cæcum there was a sudden torsion of the ileum, the part below ascending in front, the portion above returning below and behind, the two portions making between them an angle of 180 degrees from *right* to *left*. Higher up the intestine was distended, and had given way by a gangrenous slough about the size of a half-franc piece; 40 cm. above was a second torsion, probably due to traction on the distended part.

From December, 1895, to December, 1898, H. Littlewood operated on 7 cases of volvulus—4 of the large intestine and 3 of the small intestine. There were three recoveries—2 of the large and 1 of the small intestine. None of the cases involved the entire mesentery. Only those of the small intestine are given here.

CASE 15. *Volvulus; operation; recovery.* (*a*)—Operated on June 9, 1897, on a woman, aged thirty-two years, taken sick June 3d with pain in the abdomen; later with obstinate constipation, vomiting, and abdominal distention. Pulse 150 and full. Ether was given and the abdomen opened in the middle below the navel. Three or four ounces of foul-smelling red liquid escaped. Some coils of small intestine were dark purple in color, distended and adherent to other coils. Fourteen inches of small intestine were found twisted from *right* to *left* on its mesenteric axis, making rather more than one complete turn. It was untwisted, and, though deeply grooved, was left and placed next the incision, which was closed, with drainage. The patient had thrombosis of the right femoral vein, and three days after the operation (June 12th) a fecal fistula formed in the wound, and on the 24th a foot of decomposed small intestine, in the form of a slough, was removed through this opening. She recovered except for the artificial anus, which was closed by a laparotomy and paring and uniting the edges, August 11th. Complete recovery.

CASE 16. *Volvulus; operation; death.* (*b*)—Operated May 5, 1898, on a man, aged fifty-three years, sick since April 29th with abdominal pain, vomiting, and abdominal distention, more marked on the left side. Temperature not above normal, but pulse 130. No tumor could be felt. On opening the abdomen blood-stained fluid escaped; purplish-colored, distended intestines were pulled out, and a volvulus involving several feet of small gut was found, the twist being from *left* to *right* on its mesenteric axis, a little more than one complete turn. There was one ulcer in the mesentery at the twisted point. It was

untwisted, but as it remained distended it was incised and a Paul tube was inserted. Abdomen closed, with the intestine fixed in the edges of the wound. The obstruction seemed relieved, but the patient died five days later. No necropsy.

CASE 17. *Volvulus; operation; death.* (*c*)—Operated March 16, 1898, on a man, aged twenty years, taken suddenly ill on the 13th, three days before, in the night, with acute pain about the umbilicus, which continued with vomiting, offensive in character; bowels not opened since the 11th. Abdomen slightly distended, rigid; no tumor. A *doughy sensation* in the pelvis on rectal examination. Under ether the abdomen was opened in the middle line below the navel; some peritonitis; intestines collapsed in the pelvis; distended above. A volvulus of two or three feet was found, the small intestine being twisted from *left* to *right* on its mesenteric axis one turn. It was untwisted and the intestine torn in doing so, but the rent was closed. Patient died on the 18th.

Necropsy showed the small intestine enormously distended over its upper half. The lower four feet formed a partially untwisted volvulus and presented dark, semigangrenous patches.

CASE 18. *Volvulus; operation; recovery.*—Dr. John Rogers (reported by Dr. Elliot, Jr.) operated, July 12, 1897, on a man, aged thirty years; sailor; sick three days with severe abdominal pain, vomiting, and great prostration. Temperature slightly elevated; pulse 120 and feeble. Abdomen swollen and tympanitic, especially in the left iliac fossa. Incision in the median line opposite or through the navel gave exit to bloody serum; small intestine congested. Volvulus found in the lower part of the ileum, which was easily corrected. Vitality of the gut unimpaired. Wound closed without drainage, and recovery followed. Bloody stools followed during the next forty-eight hours especially and somewhat for two weeks.

CASE 19. *Volvulus; operation; death.*—Dr. A. B. Johnson, in 1898, saw a case of volvulus in a child, aged six years, male, sick three days with pain, abdominal distention, vomiting, and rapid pulse. The abdomen, opened in the middle, revealed a volvulus involving about one foot of the intestine about six feet from the cæcum. The part included in the twist was gangrenous, and was resected and an anastomosis made. Death next day. It was found that gangrene extended some distance beyond the section.

CASE 20. *Chronic volvulus; resection; recovery.*—Hadra reported, in 1899, the case of a woman, aged twenty-six years, who had suffered very much for four or five years with the left side of the abdomen, painful at all times, but worse on stooping or bending; a feeling of nausea frequently, bowels more or less regular, tenderness on pressure over the left rectus muscle, and a feeling of resistance opposite the umbilicus, and a *slight swelling* was felt.

Laparotomy over this point disclosed a loop of small intestine double the calibre of the parts above and below, with much thickened walls. At either end was a distinct line of demarcation or circular impression. This coil was quite congested. It was evidently a volvulus, and was resected and a Murphy button put in. The button passed by the twelfth day, the patient recovered, and was free from all her trouble.

CASE 21. *Volvulus; operation; death.*—Dr. Brown saw, in 1899, a colored woman, aged sixty years, who had suffered seven days from

acute intestinal obstruction. On admission the abdomen was enormously distended, and there was fecal vomiting. Suspicion that obstruction was caused by uterine fibroids led to opening the colon in the right lumbar region, without relief; so another opening in front, above the navel, disclosed bloody serum, flakes of lymph, and a volvulus of the small intestine. It was untwisted, and was followed by a gush of fecal matter from the colostomy wound. Death in eighteen hours.

Cases 22 and 23. *Operation on both; both fatal.*—Elosu reports two cases of torsion of part of the mesentery occurring in the service of Lannelongue in March and August, 1900. In one the mesentery had made three revolutions on its axis. Both were operated on, 90 cm. of intestine being resected in one. Death in both cases.

(*B*) Volvulus in Part, Associated Hernia.

Case 24. *Femoral hernia, with volvulus in the abdomen; operation; death.*—Dupuytren operated, in 1819, on a woman, aged seventy-four years, with a left femoral hernia larger than two fists, which had been strangulated twelve days. Taxis had failed. After opening the sac he was still unable to reduce the intestine. Symptoms persisted for two days; the intestine became gangrenous and was incised. There was no relief, and the patient died.

Necropsy revealed adhesions between the coils forming the hernia, and a figure-of-eight crossing in the bowel just before it passed under the femoral arch, the descending passing beneath the ascending portion.

Cases 25 and 26. *Inguinal hernia, with volvulus in the sac; death.*—Zuckerkandl reported, in 1887, two cases of scrotal hernia—one right, the other left—in men, aged, respectively, fifty and sixty-four years, complicated by torsion of the mesentery in the hernial sac. One was operated on, and both died.

Case 27. *Femoral hernia, with volvulus in the abdomen; death.*—L'Honneur reported, in 1856, a case of femoral hernia in a woman. The hernia was reduced, but the woman died in half an hour.

The necropsy revealed a loop of intestine three or four feet long, commencing three feet from the duodenum, twisted upon itself.

Case 28. *Inguinal hernia, with volvulus in the sac; operation; death.*—Dr. Cabot, in 1857–58, reported the case of an elderly man who had a reducible inguinal hernia, for which he wore a truss. It came down during the night, and he was unable to reduce it, and there was pain in the abdomen. Nine or ten hours later he was almost pulseless, and the tumor was about the size of a fœtal head, tense, œdematous, blue, and cold. Operation revealed a large amount of intestine twisted entirely round upon itself and in a state of complete strangulation. Death occurred before next morning.

Case 29. *Femoral hernia, with volvulus in the abdomen; death.*—Laugier operated on a case, reported in 1860, of a woman, aged forty-nine years, who had suffered six days from a strangulated femoral hernia, and found gangrenous bowel, which was opened; but the patient was not relieved, and died eight days after the operation.

Necropsy showed general peritonitis and a volvulus of the lower part of the ileum from *left* to *right* for one complete turn.

CASE 30. *Double inguinal hernia, with volvulus; operation; death.*—J. K. Fowler reported, in 1883, a case operated on by Hulke. A man, aged forty years, who had worn a truss for years on account of a double inguinal hernia, was taken with symptoms of intestinal obstruction. A volvulus of the small intestine was found. Death occurred three days later. The necropsy showed about eighteen inches of ileum near the cæcum, congested and diseased. The whole mesentery was very long—from seven to eight and a half inches from the spine to its intestinal attachment.

CASE 31. *Inguinal hernia, with volvulus in the sac; operation; death.*—C. J. Symonds reported, in 1889, the case of a man, aged seventy-two years, who had had a right inguinal hernia fifty years. It became painful one day, he vomited the next, and herniotomy showed a good deal of omentum in the sac, with a volvulus of the small intestine. This was reduced, but the patient died unrelieved.

Necropsy. No general peritonitis, but thirty-nine inches from the cæcum was a coil of ileum nine and a half inches long, in parts gangrenous, which had evidently formed the volvulus.

CASE 32. *Retroperitoneal hernia, with volvulus; death.*—J. Jackson Clarke reported, in 1893, a case of duodenal (retroperitoneal) hernia in a man who was taken suddenly ill with pain which caused him to fall in the street. At the necropsy Mr. Page found almost the entire small intestine in the hernia. About a foot of the upper part of the ileum was deeply congested—probably the result of having been twisted in the sac. The rest of the small intestine was normal in appearance.

CASE 33. *Double inguinal hernia, with volvulus in the sac; operation; recovery.*—J. T. J. Morrison operated, October 1, 1894, on a man, aged thirty-eight years, laborer, who had had a double inguinal hernia for several years, for which he wore a truss. During a fit of coughing the left side increased very much in size, with agonizing pain bordering on collapse, but no vomiting. Operation five hours later. Blood-stained fluid escaped on opening the sac, and about a yard of small intestine, which was only slightly congested; but another coil, about twelve inches long and very dark in color, was seen deep in the sac. This loop was twisted around its mesenteric axis, and was evidently the cause of the acute symptoms and blood-stained fluid. The intestine was untwisted, reduced, and the radical operation for cure performed. Recovery followed.

CASE 34. *Retroperitoneal hernia, with volvulus; operation; recovery.*—Neumann reported, in 1897, the case of a woman, aged fifty-five years, who was taken, six days before operation, with sudden cramps in the abdomen, vomiting which became stercoraceous, and obstinate constipation. Abdomen moderately distended and tender. Operation disclosed a right duodenal hernia, the sac containing the bowel lying to the right of the spinal column, and forming a tumor larger than a child's head. Part of the intestine was withdrawn by traction on the lower part (ileum), when it suddenly ceased, and examination showed a loop of bowel twisted into a pedicle. It was untwisted with difficulty in the sac and withdrawn. It was about half a metre long, blackish-blue in color, surface dull in places, and the mesentery was œdematous and contained infarcts. Recovery followed.

CASE 35. *Umbilical hernia, with volvulus in the abdomen; death.*—R. L. Knaggs operated, May 17, 1897, on a woman, aged sixty-two

years, with a large strangulated umbilical hernia. She was taken the day before with intense pain in the hernia and vomiting. Operation six and a half hours after the attack began. Pulse 54 and of good volume. Blood-stained fluid and several feet of small intestine, distended and black with blood, were found in the sac. There was no constriction at the hernial ring. The opening was enlarged and the intestines withdrawn until healthy bowel was reached; then a volvulus involving between four and six feet of small intestine was found and released by a half turn and the intestine returned. The patient had some relief, and passed feculent matter and sanious fluid, but death occurred after forty hours. No necropsy.

CASE 36. *Scrotal hernia, with volvulus in the abdomen; operation; death.*—R. L. Knaggs operated, October 4, 1898, on a man, aged fifty-six years, who had long suffered from a left irreducible inguinal hernia. He was taken thirteen hours before with pain in the umbilical region, followed by vomiting, swelling of the hernia, and seven or eight hours later the passage of a quantity of bloody fluid and clots. Pulse 84.

On opening the sac, dark fluid and about three feet of small intestine were found—a part almost normal and the other part congested and covered with bloody fluid. The trouble was not at the abdominal rings, and the finger introduced detected something like a band inside. The intestine was drawn down until it became healthy, when a constricted point was found. As the patient's condition was bad, the intestine was reduced, in the hope that the volvulus would untwist, and the wound was closed. Death occurred twenty-seven hours later.

The necropsy showed that the lowest four feet had made a single half turn from right to left, "so that at the neck of the volvulus the termination of the ileum lay over and directly across the ileum at a point some feet above the valve." The greater part of the loop had been in the hernial sac. Cause of death suggested was shock and fecal intoxication.

CASE 37. *Femoral hernia, with volvulus; resection of gangrenous part; recovery.*—Dreesman operated, May 7, 1898, on a woman, aged thirty-seven years, with a right femoral hernia. She was taken the day before with pain, swelling of the hernia, which became as large as two fists and tender, and vomiting. Pulse 160. On opening the sac dark-colored fluid escaped, the intestine was gangrenous, and the gangrenous portion extended into the abdomen and could not be drawn out. The abdomen was opened by extending the hernial incision, when more dark fluid escaped, and a volvulus of the lower part of the ileum, from *right* to *left*, one half turn, was found. About 7 feet (2.15 metres) of gangrenous intestine were resected and the proximal end inserted laterally into the colon. Recovery followed.

CASE 38. *Inguinal hernia, with volvulus in the sac; operation; recovery.*—J. C. Da Costa reported, in 1899, the case of a man, aged forty-nine years, with an old, very large inguinal hernia, which nothing would retain in place. Three days before operation there had been pain in the hernia and in the abdomen, tenderness and nausea, but no vomiting. The sac contained the cæcum, appendix, most of the ascending colon, and a considerable portion of the ileum and omentum. A portion of the ileum was found twisted, adherent to surrounding structures, deeply congested, and strangulated. The omentum was removed, the intestines reduced, and the patient recovered.

CASE 39.—See page 803.

CASE 40. *Femoral hernia, with volvulus in the abdomen; death.*—This patient, seen by me, was a white woman, aged sixty-two years, who had had a left femoral hernia many years. It came down on the night of April 24, 1902, and she was unable to reduce it. Next day she was in pain, and began to vomit. When I first saw her, on the 26th, the abdomen was soft, not swollen, but was tender, as was the hernia. Pulse 120, and vomiting was stercoraceous. Patient refused operation, and died about forty-eight hours after the first symptoms appeared. Necropsy showed slight peritonitis, but considerable effusion of dirty yellow serous fluid. The hernial sac contained about one inch of gangrenous ileum about twelve inches from the cæcum, tightly constricted by the femoral ring. Within the abdomen was a distended coil of intestine continuous with the portion in the hernial sac. The coil formed a volvulus about two feet long by turning on its mesentery from right to left a half turn, and was held in place by the hernia. Reduction of the hernia permitted the volvulus to untwist.

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INTESTINAL PERFORATION DURING THE COURSE OF TYPHOID FEVER, AND ITS SURGICAL ASPECTS.

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Frequency and Mortality of Perforation. While the percentage of deaths resulting from typhoid fever, and more particularly the proportion of these deaths due to perforation of the bowel is a well-established fact and quite generally known, we believe that the specific appreciation of the appalling number of these individual cases of perforation is by no means appreciated by the medical profession in general. While we all appreciate that the death rate from typhoid fever is from 7 to 14 per cent., averaging, probably, for the entire United States about 10 per cent., and that of these fully one-third are due to perforation, we think that few could have read without marked surprise the statistics recently collected by Dr. H. M. Taylor in an article on "Typhoid Perforation: Its Frequency, Prognosis, Diagnosis, and Treatment," *New York Medical Journal*, February 1, 1902, vol. lxxv. p. 193. From various statistical sources gathered in 1896 the author has determined the number of cases of typhoid fever in the United States as about 500,000 per annum, and the death rate about 50,000, which is doubtless a very fair average mortality. The frequency of perforation has been so definitely established from so many sources as being about 33⅓ per cent. of the deaths, that this number can hardly be questioned. This would give a death rate of something over 16,660 cases from perforation in typhoid fever in one year in the United States. Of this number it is now definitely known that 5000 to 8000 cases annually can be saved by operative interference. These figures represent, we believe, an adequate appreciation of the usefulness of surgical interference in the United States at the present time, and are certainly striking and instructive.

Owing to the very rapid medical and surgical progress along the lines of diagnosis and treatment in typhoid perforation during the last five years, the usefulness of operation in such cases has become established so far beyond the possibility of any doubt that it is no longer found necessary to urge and justify the procedure in the large majority of the cases. The question of recovery in such cases without operation is a matter of very grave doubt, although it has been absolutely known to occur in a few isolated instances where the damage was well localized near the cæcum, the cases assuming more the characteristics of appendicitis than those of perforation. It is an unwarrantable assumption, however, that unoperated cases recovering from mild or even

marked symptoms of perforation are actual cases of recovery from perforation itself. At a time when medical treatment was practically the only means employed, the possibility of recovery was a very serious question even among the best authorities. In an article by Dr. R. H. Fitz (*Transactions of the Association of American Physicians*, 1891, vol. vi. p. 200) on "Intestinal Perforation in Typhoid Fever: Its Prognosis and Treatment," the author states: "Since perforation of the intestine in typhoid fever may take place without any subjective symptoms, and since suggestive—even so-called characteristic—symptoms may occur without any perforation having taken place, it must be admitted that recovery from such symptoms is no satisfactory evidence of recovery from perforation." Any practitioner who has been intimately associated with typhoid fever for any length of time has seen cases of typhoid suggesting perforation that have gone on to recovery, but too often there has been an unwarranted assumption that perforation actually occurred, and the instance has been mentioned as a remarkable cure. Since the usefulness of operation has been established in these cases it has become a well-known fact that the gravest symptoms of perforation may be present without the actual lesion, and, on the other hand, a rather premature assumption from vague symptoms has been absolutely justified by the discovery of perforation at operation. It is needless to say that these remarks apply to the diagnosis of perforation and not to the diagnosis of general peritonitis following perforation. The same position, however, the lack of signs and symptoms corresponding to the actual pathological condition, has been long since established with reference to general peritonitis that has recently been demonstrated with reference to typhoid perforation. The man who assumes an unassailable position in either one of the above-mentioned conditions in instances which cannot be subjected to actual demonstration, can no longer be considered to hold a tenable and justifiable position. It must be admitted at the present time that it is a far safer and much more justifiable assumption that the mortality in unoperated cases of intestinal perforation in typhoid fever is practically 100 per cent.

It was eighteen years ago that the first operation for perforation was performed. Dr. W. W. Keen, in 1898, in his book on *Surgical Complications and Sequelæ of Typhoid Fever*, published a table of 83 cases collected by Dr. T. S. Westcott, and in the *Journal of the American Medical Association* for January 20, 1900, in an article on "The Surgical Treatment of Perforation of the Bowel in Typhoid Fever," the same author gives a table of 75 additional cases collected by Dr. M. B. Tinker, 158 cases in all, which were considered to include all the cases published to January 1, 1900. Since that time the number of published cases has rapidly increased, but owing to greater familiarity

with the subject and the increased frequency of operation it is believed that the number of published cases is far below the number of operations performed, especially in unsuccessful cases. The majority of the reports have been glaringly incomplete, indicating either a deplorable lack of scientific observation, or failure on the part of the writers to appreciate the increasing necessity for careful and detailed reports in such cases. The grosser and more evident facts with reference to diagnosis have already been well established, but the refinements in diagnosis which are going to make it possible to detect the occurrence of this complication at a much earlier stage and in a much larger proportion of the cases are still lacking. The question of general peritonitis ought not to enter at all into the consideration of perforation. Many of the pathognomonic signs, so-called, of perforation are now known to be merely an indication of general peritonitis. It is only by keeping these two conditions distinctly separated in the general medical mind that the diagnosis of perforation is to be more frequently and more accurately made, and it is only by strict and careful attention from now on to the refinements of diagnosis that we shall be saved the humiliation of operating for perforation and so frequently finding extensive peritoneal infection. Much improvement in operative technique at the present time cannot be expected, as this has already reached as advanced a stage of perfection as our present surgical knowledge will permit. Improvement is to be looked for almost entirely along the line of early and accurate diagnosis, which can only be the result of careful clinical observation, and what is of equal or even greater importance, of accurate pathological study. The pathology of these cases, especially the information afforded by extended post-mortem examinations in unsuccessful cases, has been even more neglected than the clinical study, whereas the whole question of prognosis and of the causes of death depend absolutely upon post-mortem findings. With but relatively few exceptions it has been assumed that the mortality following operation has been due to general peritonitis. It cannot be denied at the present time that this is not for the most part a correct view, but the comparatively few post-mortem examinations recorded certainly indicate that a good many of the unsuccessful cases die from causes entirely independent of the operation, and which at the present time are beyond means of control. It is in the hope of stimulating interest in the more uncertain points of diagnosis, and especially in the pathological knowledge of these cases, as well as affording some definite suggestions for accomplishing these objects, that the present article is presented. Many of the observations contained in this paper have been suggested by cases of typhoid perforation studied at the Lakeside Hospital in Cleveland during the last four years, several of which were reported by the writer from the surgical clinic of the hos-

pital in THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES, January, 1902, vol. cxxiii. p. 38, "Laparotomy for Perforation in Typhoid Fever."

It may seem at first that it requires considerable temerity to speak of the diagnosis of typhoid perforation from a purely surgical standpoint. The view of the medical profession, however, has changed so radically with reference to the treatment of perforation, that it may almost be said to come under the head of a surgical rather than a medical complication, in the same manner in which appendicitis is now brought to the observation of the surgeon, not solely at a time when operation is immediately demanded, but for the sake of diagnosis in doubtful or somewhat obscure conditions. Surgical aid in the diagnosis of appendicitis has become of the utmost value, and we feel equally certain that much the same consideration will prevail with reference to typhoid perforation. It is largely on this account that the surgical interest in typhoid fever in general has recently become so manifest. The physical conditions of the abdomen are often so altered during the course of typhoid fever that the surgeon who is unfamiliar with the typhoidal abdomen is utterly incapable of giving a well-considered opinion in cases of suspected perforation. It was in view of this fact that Dr. Osler, a few years ago, so strongly urged the desirability of surgical observation of the typhoid cases at the Johns Hopkins Hospital, and it is largely on account of the lack of opportunity for such observation among surgeons in general that so little has been done on the subject outside of large hospitals. The desirability of surgical familiarity with the abdominal conditions in all stages of typhoid fever cannot be too strongly urged, and its importance cannot be over-estimated.

ETIOLOGICAL CONSIDERATIONS. In considering the subject of intestinal perforation in typhoid fever, there are a number of points in the etiology of the condition which have already been determined with all the accuracy that is desirable, and which can be dispensed with in a few words. The *time at which the perforation occurs*, so far as diagnosis is concerned, is of no consequence. It most frequently occurs during the third week, but in one of the Lakeside series there were very marked suggestions of perforation in one case on the fifth day of the disease, although no perforation was found, and in another case general peritonitis had followed a perforation occurring on the sixth day, as nearly as could be made out from the history. It may occur late in a prolonged convalescence, or in a relapse, so that from a standpoint of diagnosis the stage at which the patient has arrived in the illness must be entirely overlooked. The time of perforation is of much consequence, however, with reference to the general condition of the patient and to the way in which operation is borne, as will be

mentioned later. The *severity of the fever* can be overlooked entirely in diagnosis, except for the fact that diagnosis is more difficult in severely sick cases, where one scarcely ever finds the indications so marked. It is the opinion of Dr. Osler that it occurs more frequently in severe cases; but medical opinion in general is quite divided, and from the study of the reported cases one is certainly justified in a conservative opinion. It certainly appears to occur about as frequently in mild as in severe cases, and in any event it occurs so frequently in both classes that the mildness or severity of the disease can be entirely laid aside with reference to diagnosis. The matter of *constipation and diarrhœa* is of little consequence in diagnosis, the cases being so equally divided that these conditions can also be overlooked. The question of *age and sex* is of slightly more importance, but this also can be overlooked almost entirely. It occurs much more frequently in young adults, but three or four cases have been reported in children under fifteen years. It also occurs much more frequently in males than in females. Neither of these conditions can influence the diagnosis to any appreciable degree, however, except that one might be justified in delaying a little longer in cases of young children. It is of somewhat curious interest that only two instances of operation for perforation in a negro have been reported, and that in only one of these was perforation actually found. The question of *intestinal hemorrhage* is of somewhat more importance, but mainly from the fact that its occurrence at the time is very apt to mask or simulate perforation and render diagnosis much more difficult. As an etiological feature, however, antecedent to perforation, we believe it can be entirely overlooked. The occurrence of hemorrhage is purely fortuitous, and depends solely upon the chance of the ulcerating surface encroaching upon a vessel of considerable size. It cannot be assumed that the ulcer is approaching the peritoneal surface more rapidly on that account, or that the process will even eventuate in perforation merely because the hemorrhage has occurred. A comparatively small number of the reported cases of perforation have been preceded by hemorrhage, and it is only a small percentage of the cases of hemorrhage that have eventuated in perforation. In instances where the relation is suggested it is almost invariably a mere assumption that hemorrhage has come from the particular ulceration that has gone on to perforation. So that in considering the diagnosis of perforation we think one can entirely overlook as etiological factors the period of the disease in which the perforation occurs, the severity of the disease, the occurrence of constipation or diarrhœa, the question of age, sex, and color, and the occurrence of hemorrhage from its purely etiological standpoint.

Symptoms and Signs of Perforation. In considering the *symptoms and signs* of perforation we believe it is of the utmost importance

to preserve a sharp distinction between the two. Some of the signs of perforation are doubtless always present, although possibly unobserved or misinterpreted. The amount of dependence one can place on symptoms, however, depends entirely upon the mental condition of the patient and his appreciation of sensations. The patient whose faculties are moderately alert can afford very material aid through his perception of pain and his own conception of being very much worse or very much better. In proportion to the amount of apathy so often present to a greater or less degree, these sensations are much less acute, and the patient's ideas regarding himself are of much less consequence. In deeply apathetic or delirious cases the question of symptoms must almost invariably be largely or entirely set aside. Consequently in the latter class of cases, which are almost always the severely sick cases, one must rely almost entirely upon physical signs and phenomena. As in so many other conditions, in the cases in which one is most desirous of making an early and careful diagnosis, the means at hand for making this diagnosis are much more strictly limited than in less severe cases where one can risk a little larger margin of error. It is thus evident that in most severe cases one is forced to be more radical in his diagnosis and establish the presumption of perforation on somewhat less sufficient grounds. These two distinctions, then, between signs and symptoms on the one hand, and the clear-minded as against the apathetic and delirious patients on the other, at once assume proportions of the very highest importance, and it does not seem to the writer that these considerations can be too strongly urged. These are distinctions to which we feel justified in making frequent reference.

Symptoms. In considering first the symptoms of perforation one finds for consideration pain, sensitiveness, the sensations associated with systemic shock, and the sensations of altered respiration. These have been named in the order of their relative importance in the vast majority of cases in which the sensibility of the patient is sufficiently acute to make them of any use whatsoever.

Abdominal pain is by far the most important symptom, and if present demands the utmost consideration in forming a diagnosis. This is especially true where the patient has been comparatively free from previous abdominal complications and the symptom appears as a sudden, sharp, often agonizing sensation, quite circumscribed, located in the lower part of the abdomen near the median line or toward the right side; and especially if the pain remains severe and circumscribed for an hour or more. Such a picture one can scarcely mistake, and with a very slight suggestion along the line of physical signs one must feel justified in making the diagnosis. The pain, however, may come on gradually, commencing almost anywhere in the abdomen, but more frequently starting near the median line, near or below the umbilicus.

If the pain is general at the start it usually becomes more closely confined to the lower half of the abdomen within a short time. When pain becomes more general after having been moderately well localized at the start, it suggests rather strongly that peritoneal infection is progressing from a point of perforation. The pain, whether sudden or general in its first manifestations, localized or diffuse, may at the same time be either moderate or severe; in general it can be said that the better localized the pain the more keenly it is appreciated, but the distinction is of vastly less consequence than the fact itself that pain is present. So that the occurrence of pain is a feature of the utmost importance when present. The location of the pain, its limits, its severity, the manner of appearance, and persistence are matters of secondary importance, except possibly the last-mentioned feature. In proportion to the degree to which these various features of the pain are accentuated these secondary considerations of pain may be said to be of importance, but the absence of such accentuation must be almost entirely overlooked in arriving at a diagnosis.

Sensitiveness is, of course, very closely allied to pain, and may almost be considered as a less strongly marked manifestation of the same sensation, so that many of the things mentioned with reference to pain are true to a less degree with reference to sensitiveness. All patients with abdominal pain are sensitive, but one is often obliged to rely considerably upon sensitiveness as a symptom in the absence of pain. The limits of sensitiveness are usually more narrow than those of pain, and on this account it is sometimes of aid in assisting the patient to more definitely locate his pain. Localized pain is accompanied by localized sensitiveness, but diffuse pain is not infrequently associated with circumscribed sensitiveness, and this fact is often an aid of considerable importance. Spreading sensitiveness is open to the same interpretation as spreading pain, and is if anything a little more to be relied upon. The occurrence of sensitiveness is more common to the lower half of the abdomen or to the entire right half. Its frequent occurrence in the right lower quadrant, to which attention has been strongly called by several writers, does not appear to exist in many cases. The truth of this statement has been strongly suggested by the Lakeside series and seems to be justified by the large proportion of reported cases. The degree of accentuation increases the usefulness of sensitiveness, also, as a symptom, possibly a trifle more so than in cases of pain; but here again the characterizing features of sensitiveness are of only secondary importance as compared with the presence of sensitiveness itself.

The *sensations associated with systemic shock* vary so greatly in different patients, and are so closely allied to certain signs to be mentioned later, that one is obliged to speak of them in a very general way. These

sensations, general and varying as they are, however, in a responsive and clear-minded patient are worthy of careful consideration when present. Perhaps their meaning is best described by the expression so often used by the patient himself, literally or implied, of an "all-gone feeling," as if the "bottom had dropped out of him;" a feeling vaguely described but strikingly realistic, that some serious catastrophe has occurred. It is doubtless this that sometimes causes in these patients the intensely anxious and apprehensive countenance not infrequently seen, the exact meaning of which they are unable to put into words. It is scarcely possible to speak of these sensations in more detail. Their presence is unmistakable and of considerable importance; their absence, again, may be entirely disregarded in making a diagnosis.

The *sensations of altered respiration* are of little consequence compared with the other symptoms mentioned, or compared with respiration as a sign. The patient is apt to feel short of breath, and finds that his respirations for some reason or other must be largely costal. As a sensation it is present in almost direct proportion to the intensified characteristics of pain already mentioned, and in the absence of pain, at least in the absence of pain and sensitiveness, it does not exist. The symptoms of altered respiration are of so little consequence that they may be entirely disregarded.

Signs. But it is upon the signs suggesting perforation that one is forced to rely largely, and in apathetic and delirious cases one must rest his diagnosis upon these signs almost absolutely. Here, however, it is necessary to draw the distinction even closer between perforation and general peritonitis, and keep in mind that the diagnosis of general peritonitis is not the diagnosis of perforation. And against maintaining this distinction one cannot with propriety set the fact that both these conditions at times are very bizarre and misleading in their manifestations, and that occasionally the postmortem examination reveals a condition of which the manifestations before death gave absolutely no recognizable indication. These signs suggesting perforation include, first, indications gathered from the abdominal examination alone, such as muscular resistance, the presence of gas within or outside of the intestine; and, second, certain general systemic indications, such as vomiting, altered respiration, temperature, pulse, altered blood conditions, and general systemic shock.

Muscular resistance is, we believe, the most important of all these signs. It is a sign of the utmost importance in almost any acute intra-abdominal condition, and its reliability can rarely be questioned with impunity. It indicates very clearly that the abdomen is trying to protect itself against injury from the outside, and is a condition largely independent of the volition of the patient. The presence of pain and sensitiveness is, to be sure, usually associated with muscular resistance

to a greater or less degree, but the same patient, if he is deeply apathetic or delirious, and abdominal protection is still needed, would show muscular resistance. This muscular resistance is not infrequently general, but in cases of perforation in typhoid fever, since the lesion is almost invariably located in the lower half of the abdomen or on the right side, the resistance is accentuated in these localities. Its usefulness is impaired to an inexperienced observer, however, in that many cases of uncomplicated typhoid show a varying amount of muscular resistance which must not be mistaken by one seeing the case for the first time. Here, again, is a very striking example of the necessity for surgical familiarity with the abdominal conditions in uncomplicated typhoid, and also of the great desirability of having typhoid cases under frequent surgical observation. Muscular resistance is probably never absent in perforation. If resistance was present before perforation it is probably always increased, and in such cases an accurate estimation of the degree of increased resistance is of great value.

Distention and tympany from gas within the intestines are signs of no consequence with reference to perforation *per se*. Their absence is of equal inconsequence. As signs of spreading peritoneal infection, however, they are both of well-known and merited consequence and need not be discussed here. They are confirmatory evidences only in so far as one has been willing to run the risk of spreading infection secondary to the perforation. If there was gas in the intestines previous to perforation, as is frequently the case, it would not be increased by the accident; if the abdomen was soft and there was no distention one would not find a sudden accumulation of gas when perforation occurred. So that aside from the fact that distention and tympany may tend to obscure the diagnosis and render it more difficult they can both be set aside entirely with reference to the diagnosis of perforation itself, and are confirmatory only in proportion to the degree of spreading infection.

The presence of *abdominal gas outside the intestine*, however, if its presence can be demonstrated with certainty, is practically a proof of perforation. Such evidence is usually sought through obliteration of the liver dulness. This manifestation, however, is a matter of such uncertainty that it renders the interpretation of the sign of practically no value. The obliteration of liver dulness has been demonstrated again and again to be due to a distended colon or small intestine as well as to free abdominal gas, and in several cases in which diagnosis was considered practicaly absolute on account of this sign, no perforation was found. The absence of altered liver dulness is, of course, a matter of absolutely no consequence in diagnosis, and in cases where the liver dulness is altered to an appreciable extent, it is quite impossible to say whether it has been effected by free abdominal gas or dis-

tended intestine. If the liver dulness is altered one may be justified in being suspicious of the circumstance, but we feel he is unjustified in any further assumption.

Nausea and vomiting occur so infrequently that they are of little aid in the diagnosis, and their absence may be entirely set aside. They are more frequently associated with cases in which there is severe pain, and in these cases are probably open to the same interpretation as nausea and vomiting under any condition of severe abdominal pain. They are also seen, however, as manifestations of severe systemic shock, but in such cases the presence of shock is so manifest that one need not look for the confirmatory evidence of vomiting. They occur in less than 25 per cent. of the cases. Their presence is of slightly confirmatory value only.

Altered respiration is a sign of consequence, and is probably to be interpreted as muscular resistance, namely, a means of protecting the abdomen. The prevailing type of respiration where perforation has occurred is almost invariably distinctly thoracic. This type of respiration is also seen in severe cases of typhoid with distention and rigidity, but the phenomenon is considerably accentuated when perforation occurs. It was a very striking sign in all the Lakeside cases. It is rather more evident, to be sure, in clear-minded patients with considerable pain, assuming somewhat the quality of a symptom; but it is sufficiently recognizable as a sign alone where the mental condition of the patient is to be entirely disregarded. The rate of respiration, also, is nearly always more or less increased, but is of largely secondary consequence. If the patient is in pain, respiration may be unduly increased on this account alone; if he is insensible to pain, the restricted respiratory excursion will necessitate somewhat more rapid breathing. Altered respiration, then, of the costal type warrants much the same assumption as muscular abdominal resistance, and we believe this alteration can be found in practically all cases if sufficiently well observed. As this alteration is largely relative it is probably less reliable than muscular resistance, and as it is open to the same interpretation its practical value, aside from being merely confirmatory, is not great. Its absence, however, as in the case of muscular resistance, must be considered of considerable importance.

Alteration in temperature may be of some positive value, but the absence of such alteration must be set aside entirely in making a diagnosis. An accompanying chill is of rather infrequent occurrence. Two of the Lakeside cases showed no alteration in temperature, and many other reported cases are equally negative in this respect. Many cases will show a rise or fall generally not exceeding 2° F., which, when considered with the usual irregularity of the typhoid chart, must be admitted to be of little value. A very decided drop in temperature,

as is sometimes seen in hemorrhage, is rather less frequently met with in perforation, we believe, than has been generally supposed. As an indication of spreading infection the value of altered temperature has long since been well established, as was mentioned also with reference to distention and tympany; but as an indication of perforation itself the matter of altered temperature may be very largely overlooked.

The *pulse* is an indication of greatest importance. It is, of course, an evidence of systemic shock accompanying perforation, but is a matter of such consequence that it deserves special mention. One can almost invariably expect a rise in pulse that is quite marked, perhaps twenty beats or more, the alteration occurring rather suddenly. This rise in pulse is affected in a measure by the increased respiration, but is almost always too marked to be accounted for entirely on such grounds. The quality of the pulse also is markedly altered, the tension being reduced, and the pulse rendered readily compressible. These strikingly distinctive changes in the rate and quality of the pulse are, of course, less strongly marked in more severely ill cases, in which the pulse is already rapid and the quality poor, but even in such cases, to one familiar with the daily condition of the patient in question, the relative alteration is evident. It may also be of some aid in differentiating between shock and hemorrhage, as alteration in rate and quality is likely to be more gradual in hemorrhage; it is a distinction, however, that is by no means always recognizable, but may serve as a somewhat confirmatory observation. Sudden marked alteration in rate and quality, then, is an indication of great importance.

Definite knowledge regarding *altered blood conditions* occurring in typhoid fever is so meagre that we feel that little reliance can be placed upon it in making a diagnosis of perforation. This may appear at first sight to be a rather striking and radical statement. In the large proportion of cases it is very doubtful if *the white blood count* is affected by the perforation itself. It is true that in many instances a leucocytosis is observed to follow perforation at an interval of anywhere from one to six hours; but, on the other hand, in a very considerable number of cases no such leucocytosis is observed. It has also been observed that moderately sudden and quite extreme leucocytosis occurs in patients in whom perforation was supposed to exist, when operation showed definitely that none had occurred. One of the Lakeside cases showed such a rise from approximately 8000 to 50,000. It has been assumed by some and considered demonstrated by others that following perforation there is a "wave of leucocytosis" extending over a period of a few hours, and that in cases where no leucocytosis is observed the observation has been made at the close of this wave. Some cases show this condition, others do not. Whatever one's belief regarding it may be, it is known to be a certainty that the leucocytic equilibrium in man

is very easily disturbed to a greater or less extent. Some of the causes that at times effect this disturbance are known with a moderate degree of certainty, but the number of causes with which we are somewhat acquainted is probably very small as compared with the number of causes for which we are utterly unable to afford any adequate explanation at the present time. Slight temporary differences in the white blood count are usually beyond explanation, and while it may be assured that such temporary flights occur in perforation it is an assumption that must be based upon far wider and much more accurate observation than has been made thus far. These waves of leucocytosis have been demonstrated to exist in many conditions, and for that matter in supposedly normal individuals, which had they occurred in conjunction with symptoms suggesting perforation might be assumed to be due to that cause. One such set of observations has been made by Cabot, Blake, and Hubbard in an article on "A Study of the Blood and Its Relation to Surgical Diagnosis," *Annals of Surgery*, vol. xxxiv. p. 361. These views are based upon the observation of only ten cases, to be sure, four of which were typhoid fever, but they are as extended and certainly more accurate on the whole than any observations in favor of the leucocytic wave theory in perforation, and serve to put the subject where one is unable to attach to it much diagnostic importance at the present time. What may, however, prove to be of some consequence is a steadily increasing leucocytosis reaching a well-marked maximum, which is attained after a considerably longer period than the height of the so-called wave. The interpretation of this increase, however, is largely an assumption; it may be due to spreading infection which has not yet become sufficiently marked to cause the fall in the number of leucocytes not infrequently seen in cases of extensive peritoneal infection. Be this as it may, it must be admitted to be of relatively small practical importance, for if these cases are to be saved one must not wait for a well-developed leucocytosis from any such cause. There is a great though apparently decreasing tendency to overestimate the value of leucocytosis in surgical abdominal conditions at the present time, and we feel that this is an example. The irregularity noted in the blood examinations in cases of demonstrated typhoid perforation is so great that the subject needs far wider and much more accurate study than has thus far been given. But while from the standpoint of diagnosis the question of leucocytosis must be largely set aside, from the standpoint of careful and complete observation of cases the importance of such examination cannot be overestimated. The subject may have possibilities; before leaving it the absence of such possibilities must be thoroughly demonstrated.

Alteration in the amount of *hæmoglobin* and the number of *red blood corpuscles* in these cases is a matter that has been almost entirely over-

looked, but from a theoretical standpoint it would appear to be of somewhat more consequence than the white count. The most difficult cases for diagnosis are those in which the decision lies between hemorrhage and perforation. If the diagnosis of hemorrhage is incorrectly made, and instead of this perforation has occurred, the desirable opportunity for operation is lost while waiting for the demonstration of hemorrhage through the bowel discharges. It may be possible to make use of the red count and the estimation of hæmoglobin as affected by hemorrhage to aid in the differential diagnosis in these cases. The white count can be of little aid in this differentiation. It is felt that some careful observations along this line will prove valuable.

Systemic shock is probably always present, although not always recognized, and is an indication of the very greatest importance. The condition is usually so evident and its indications so readily recognizable that it is scarcely necessary to consider it in detail other than to insist on its importance. Altered respiration to a slight degree possibly, and especially alterations in pulse, temperature, and blood are indications of general systemic change. The pallid countenance, the drawn facial expression, slight cyanosis of lips and finger-nails, the sudden occurrence of perspiration, and the slight tremor that is sometimes present, together with the altered pulse and temperature, make a very striking picture when well marked. Here, again, however, in proportion as the organism is deeply affected by the disease itself, the margin of vitality susceptible to even the severest degree of shock is narrow, and the system may be so deeply affected that it fails entirely to respond in any appreciable degree to the shock received, and the catastrophy passes unrecognized. It must be kept in mind, however, that this is said solely with reference to the severity of the infection, and is entirely independent of the mental condition of the patient. Shock is distinctly recognized by physical, not mental demonstrations, and if any reactionary power remains in the organism the condition can be recognized in spite of delirium or apathy. This condition of systemic shock was observed in all of the Lakeside cases. In one case with severe infection and moderately well-marked shock no perforation was found, and the cause of the suddenly altered condition was never demonstrated.

In summary, then, the signs and symptoms upon which one is forced at the present time to rely mainly in making a diagnosis of perforation are *pain, sensitiveness, muscular resistance, altered respiration, alteration in rate and quality of the pulse, and evidences of systemic shock.*

Differential Diagnosis. The question of differential diagnosis is a matter upon which there is little to be said with satisfaction, owing largely to our fragmentary and quite indefinite knowledge of the causes of pain during the course of typhoid fever. Pain must be considered a most important symptom, and at times the most important

feature in making the diagnosis of perforation, but at the same time it is the indication which most often leads us astray. A most instructive and commendable paper by Dr. Thomas McCrae, "Abdominal Pain in Typhoid Fever," *New York Medical Journal*, May 4, 1901, vol. lxxiii. p. 749, is perhaps the most valuable article of its kind that has occurred in the more recent literature. His report is based upon the analysis of 500 cases at the Johns Hopkins Hospital, in which it was found that only two-fifths of the patients were free from pain or tenderness; one-fifth showed tenderness only, while two-fifths showed pain sometime during the attack. Of this number there were only 13 cases of perforation, while in 70 cases there was no discoverable cause. It must be admitted that in a large proportion of cases in which the existence of perforation has not been demonstrated at operation, the causes of the indications leading to the diagnosis have not been discovered, and in instances in which the causes have been assigned it was largely an assumption. Among these causes, known or supposed, are diaphragmatic pleurisy, pneumonia, iliac thrombosis, appendicitis, peritonitis from undiscoverable causes, intestinal obstruction, suppurating mesenteric or retroperitoneal glands, cholecystitis, and intestinal hemorrhage.

Regarding *pleurisy* and *pneumonia*, they have both been known to be associated with abdominal pain, the entire aspect of the case resembling very closely that of perforation. If the pneumonic process is not sufficiently near the surface to be recognizable, one can have little hope of avoiding the mistake. A careful pulmonary examination in all cases is the only possible precaution. Such cases are, however, fortunately, very rare. *Iliac thrombosis* is usually associated with sensitiveness in the groin and for a varying distance along the course of the femoral vein, and a careful examination may reveal this cause of a misleading symptom and should always be carefully kept in mind. *Appendicitis* occurring during the course of typhoid fever can very rarely be differentiated from perforation occurring in or near the cæcum, and there is fortunately no need for so doing, as the indications for operative interference are so nearly identical. *Peritonitis* without discoverable cause has been mistaken for perforation, but can scarcely give the early appearances of perforation; in either event, however, immediate interference would be indicated. *Intestinal obstruction* has simulated perforation, but here, too, the instances in which it would simulate the early symptoms of perforation must be extremely rare, while the indications for exploration would be equally certain. The considerations of consequence in connection with appendicitis, peritonitis, and obstruction with reference to perforation are not so much in relation to the difference in diagnosis, but that the conditions must be kept in mind as possible causes of the symptoms and signs in cases in

which no perforation has been found. The same may be said of cases of *suppurating mesenteric or retroperitoneal glands;* this condition can scarcely be mistaken for perforation pure and simple, but has been mistaken for resultant indications of perforation due to spreading infection. *Cholecystitis* has simulated perforation very closely, as in the case reported by Dr. H. B. Allyn, "Typhoid Fever, with Perforation of the Colon and Gall-bladder: Operation; Death; Autopsy," *Philadelphia Medical Journal,* August 3, 1901, vol. viii. p. 193. In this case no perforation was found, the existence of cholecystitis was not discovered at the operation, and the cause of the misleading indications was found only at autopsy. In such cases, however, the pain is usually high in the abdomen, and is very likely to be associated with slight jaundice or a trace of bile in the urine. Here, again, however, the important consideration is not the diagnosis, but the possibility of overlooking such a condition where no perforation is found. From *hemorrhage,* however, differential diagnosis is of the utmost importance. Less than half of the cases of hemorrhage are associated with pain, and it is probably the proportion is small in which perforation might be reasonably suspected. The diagnosis is of importance not so much because hemorrhage sometimes suggests perforation, but because the indications of perforation itself are sometimes attributed to hemorrhage, which is a mistake of the utmost gravity. Where the two conditions do suggest each other it is a diagnosis of the greatest difficulty, and in the present state of our knowledge there is relatively little to aid one. The pain and sensitiveness may be the same, the signs themselves may be almost identical. Alteration in the rate and quality of the pulse, however, may be more gradual in hemorrhage, but the difference is purely relative and not always of assistance. The evidences of systemic shock are usually more severe in perforation, but this is also a relative difference and merely a suggestion. As the case progresses the diagnosis of hemorrhage is usually rendered clear by the subsequent appearance of blood in the stools, but if perforation is strongly suspected one cannot be justified in delaying for this confirmation of the diagnosis of hemorrhage. The reduction of hæmoglobin and the number of red corpuscles, it is strongly believed, may be of material aid in differentiating these two conditions, as has been suggested by McCrae, and was of demonstrated value in one case at the Johns Hopkins Hospital. We feel that this is a most important subject, and would urge that it be widely investigated and reported for the sake of accumulated statistics. But when all is said it must be admitted that differential diagnosis between perforation and hemorrhage is sometimes extremely difficult and misleading, and in such instances one must feel justified in diagnosing perforation rather than hemorrhage, since the gravity of delay in perforation far exceeds that of exploration.

It may be well to mention here several things not already noted which may obscure or aid in the diagnosis. To one who is familiar with the not infrequent effects of tub baths, especially in severely ill cases, it would be suggested at once that the abdominal pain, muscular rigidity, and varying degrees of systemic shock sustained might lead one astray in a case where perforation was suspected or even where no such thought had been entertained previously, if the effects of tubbing were unusually marked. It is, therefore, a wise precaution in suspected cases to substitute sponge baths, in order that the diagnosis may not be obscured by ever so slight an alteration in the patient's condition from other than the suspected cause. In one of the Lakeside cases the sudden change in the patient's condition was thought to be due to the effects of the tubbing, and caused a disastrous eight-hour delay before operation. Again, in administering morphine in cases of hemorrhage one is courting danger on one hand while attempting to forestall it on the other. It is at once evident that in cases suggesting both perforation and hemorrhage the diagnosis should be clearly defined if possible before administering morphine. There are occasionally cases, however, in which one feels obliged to give morphine regardless of the consequences. One other suggestion which we have not seen mentioned elsewhere seemed at the time to be of material aid in the diagnosis in two of the Lakeside cases, in one of which perforation had actually occurred, while in the other operation was delayed and the case recovered. In both of these instances the question was raised whether the rather moderate abdominal pain might not be due to flatus. A small glycerin enema administered in each instance was expelled by both patients with the evacuation of considerable gas. In the case of actual perforation no relief from the pain was experienced, while in the case recovering without operation the pain was considerably though not entirely relieved. It is a procedure that is scarcely applicable in cases of suspected hemorrhage, but may occasionally afford information of more or less value where perforation is suspected independently of hemorrhage.

It may be permissible to consider in this connection the so-called "pre-perforative stage," upon the existence of which as an absolutely recognizable condition Dr. Cushing, of Baltimore, has been so persistently insistent. In the *Johns Hopkins Hospital Bulletin*, November, 1898, No. 92, p. 267, he defines his position as follows: "Under the 'pre-perforative' stage let it be understood that the whole period is included between the first involvement of the serosa with the customary formation of adhesions at this point, until these adhesions, which may for the time constitute the floor of the ulcer after the serosa has given way, have themselves become broken down and general extravasation has taken place." What he refers to is a pre-extravasation and not a

pre-perforative stage, and this distinction the writer himself mentions in a subsequent paper. That adhesions form in all cases of perforation is probable in spite of the fact that they cannot always be demonstrated at operation. That every case of perforation has what may be called a pre-perforative or pre-extravasation stage is too evident to need mention, just as anything that occurs has a pre-existent condition; but when the same writer mentions it as a "definite recognizable condition" he is insisting on a refinement of abdominal diagnosis that is quite beyond the possibility of recognition with any degree of certainty. The impossibility at the present time of recognizing a distinction depending upon the thickness of the peritoneum is self-evident. An early diagnosis is the *ne plus ultra* in perforation, and doubtless in some of these cases one may feel satisfied he has found the condition mentioned by Dr. Cushing, but it is seldom to be hoped that one will strike the exact time of perforation with such accuracy. It is firmly believed that the best that can possibly be hoped for is the possibility of operating upon these cases within a considerably wider limit than Dr. Cushing urges, a little before or a little after the catastrophe has actually occurred, and the cases in which one is able to place his operation between the involvement of the peritoneum and actual extravasation are, we believe, purely fortuitous and not a matter of judgment.

Operative Treatment. It is hardly necessary any longer to urge that the treatment of typhoid perforation is solely operative. It may not be always possible to operate, but when the diagnosis of perforation is once made one can no longer consider the patient as being under treatment if operation is not employed. So far as the patient is concerned, however, it can be safely said that operation should be resorted to in all instances. This is the only reasonable ground in even the most desperate cases. The list of recoveries contains a number of the most hopeless instances of surgery as a last resort, notably the remarkable case of Dr. Abbe, *New York Medical Record*, January 5, 1895, in which operation was performed sixty hours after perforation, and in which two pints of extravasated fecal matter were removed from the abdominal cavity; also the case of Dr. Champlin, No. 155 of Dr. Tinker's series, published by Dr. Keen in his article already mentioned, in which the interval between perforation and operation was estimated at three days; and the case of Dr. Pearson, *British Medical Journal*, 1899, vol. i. p. 1097, in which recovery followed operation nine days after perforation was thought to have occurred, although in this instance there was a localized abscess about the cæcum, the case resembling more a slowly progressing appendicitis.

The *time when the operation should be performed*, that is, the number of hours after perforation, is a matter upon which statistics seem

strangely at variance with common sense and experience. Cases of perforation are always associated with a greater or less degree of shock. To operate during the severity of this condition can scarcely be considered wise unless the period of shock is unduly prolonged. The diagnosis having been made, however, the matter of an hour or two of heat and stimulation in the severest cases will serve to get the patient in as good condition for operation as one can hope. If the systemic shock is quite inconsiderable we need not delay even this length of time. If the period of shock is prolonged in spite of treatment, we believe that the danger of spreading infection will far exceed any possible benefit derived from delaying in the hope that the patient's condition will improve. It is owing to the deplorable lack of post-mortem examinations that we are obliged to assume this position instead of accepting it from demonstrated facts. The cause of death in the vast majority of reported cases has not been accurately ascertained, and where stated has been merely a clinical assumption. The number of autopsies obtainable from the reports is far too small to justify any conclusions. It is probably true, however, that general peritonitis is the cause of death in the majority of fatal cases operated upon at an early date, and in a very large proportion of cases in which operation has been delayed. It must certainly be admitted that a case dying of general peritonitis following early operation could not possibly have been saved from this catastrophe by delaying a number of hours. The statistics of Dr. Westcott and Dr. Tinker, published by Dr. Keen, show that the largest percentage of recoveries follows operations performed during the second twelve hours after perforation. We cannot but feel, however, that these statistics, convincing as they first appear, are quite misleading. They are largely made up of the older cases, in most of which operation was long delayed and among which the recoveries were largely instances of fortuitous and unlooked-for good fortune. The fact, also, already mentioned, that the cause of death in all but a few of these cases was never definitely known affords a possibility of error that renders the statistics practically useless. In the more recent cases recovery has been much more frequent among those in which operation was early peformed. But even here, again, unless sufficient interest is exercised to demonstrate positively the cause of death in unsuccessful cases, the decision of this question must be largely a matter of general experience and not scientific demonstration.

The nature of the *anæsthetic* will often prove to be a matter of consequence, especially whether one will employ local or general anæsthesia. There are frequently serious objections to both, but we cannot at all subscribe to the feeling of certain writers who claim that local anæsthesia should be employed in all cases, and that the use of general anæsthesia is a deplorable mistake. By the employment of local anæs-

thesia it has been thought to obviate entirely the additional shock of the administration of a general anæsthetic. In some instances this is so, in others it is purely an assumption. It is too often the case that what may be spoken of as purely operative shock is largely attributed to the use of a general anæsthetic, and no one will maintain that laparotomy under cocaine, in which the abdominal contents are disturbed, is entirely relieved of shock by the omission of a general anæsthetic. The mental anxiety, worry, and dread incident to a laparotomy under local anæsthesia in a hardy, strong individual, or even in a patient whose sensibilities are dulled to no inconsiderable degree by the severity of the illness, is a consideration never to be overlooked and will not infrequently render the decision against local anæsthesia. What is to be accomplished is the greatest possible reduction of systemic shock to the patient incident to the operation, and in some instances this is best accomplished by local anæsthesia, in others by general anæsthesia. Stolid and more or less apathetic patients are more favorable for local anæsthesia. The amount of self-control an individual is able to maintain is a very uncertain indication, as the greatest self-control may sometimes be associated with extreme and very depressing mental strain. Even in those cases in which a local anæsthetic has been properly and successfully employed, it is doubtful if the extensive and careful abdominal irrigation usually required, can be as well accomplished in most instances without resorting to a general anæsthetic at this stage of the operation. As so much depends on the care and thoroughness of this part of the procedure, it does not seem always wise to complete it under local anæsthesia unless the indications are very direct.

One of the main objections to general anæsthesia is the fact that so much time is usually lost in getting the patient sufficiently under. This may be obviated by using chloroform after the administration of about one-quarter grain of morphine hypodermically; but what we feel will eventually prove a still more rapid and considerably safer method is the employment of nitrous oxide and oxygen followed by ether. By using the gas and ether alternately in getting the patient under, complete anæsthesia can be produced readily in one to two minutes, and the method is devoid of the unforeseen but ever-present dangers incident to chloroform. The prolonged use of nitrous oxide and oxygen alone may eventually displace the use of chloroform and ether altogether in these cases, but at the present time its usefulness and safety for prolonged anæsthesia has not been sufficiently demonstrated. When general anæsthesia is employed it is unnecessary to add that it should be given into the hands of one of very considerable experience, and the administration should be as light and as short as possible. One advantage of the general anæsthetic thus administered over local anæs-

thesia, which we feel is not always kept in mind, is the greater rapidity with which the operation can be done under general anæsthesia, and the considerable reduction of the exposure and handling of the patient, to say nothing of the added thoroughness with which the operation may be performed. The use of local anæsthesia in these cases is an extremely simple matter to one who has even a limited abdominal experience, but its usefulness and employment is something which should be carefully considered and not entirely assumed.

The requirements of operation are so direct and clear that the *technique* is simple, and the steps of the operation well defined and logical. As an operative procedure it has been so well developed that we can look for comparatively little improvement in this direction, and there is consequently much less of interest in this portion of the discussion. The *incision* in the right lower quadrant of the abdomen is the only logical opening in these cases, and the linea semilunaris opposite or a little above the anterior superior spine we believe to be preferable. The lower part of the ileum, the cæcum, and the appendix include the vast majority of perforations, and are, on the whole, most readily accessible through the incision mentioned. An additional advantage of this incision is the well-recognized fact that the search for perforation is best begun from the cæcum. The incision should be sufficiently generous, perhaps 8 to 10 cm. long, to allow a careful and somewhat visual exploration. It occasionally happens that the perforation is completely protected by well-formed adhesions and fecal extravasations prevented, as was the case in an operation performed by Dr. J. C. Warren, reported by Dr. R. B. Greenough, *Boston Medical and Surgical Journal*, May 8, 1902, vol. cxlvi. p. 491. If these adhesions are blindly broken up through a small incision unnecessary fecal extravasation may occur, the danger of which, owing to the certainty of the infection, cannot be estimated.

After entering the abdomen the first *search for the perforation* should be made in the ileum immediately above the cæcum, as the vast majority of perforations occur in this portion of the gut. By far the best way of accomplishing this is by starting at the cæcum, a fixed point very quickly found. We feel that this is a very wise routine procedure to employ, since one knows accurately the exact location of the small intestine he is handling and avoids the discouraging loss of time almost invariably incident to a haphazard and undiscriminating inspection of coils of small intestine appearing in the wound. Starting with the cæcum, one should inspect the ileum for a distance of about one metre. There is no object in going above this unless one intends to search the entire intestinal tract. This search for the perforation can be hurriedly but carefully conducted if the incision is sufficiently large to afford even a limited view of the general field. It is usually con-

sidered wise to replace the coils of intestine within the abdomen as the search is made, although some feel, and not without reason, that keeping the explored portion of the intestine well covered with hot towels and finally replacing all the coils at once can be accomplished with less handling of the intestines and less incident shock to the patient. We feel it is wise to make this first hurried search of the ileum for the perforation only, which is immediately recognized if present, a more careful examination of the gut for very thin ulcers being made after the really serious features are corrected, providing the condition of the patient will permit. It also affords a comprehensive conception of the portion of the bowel almost invariably affected, and prevents the possibility of spending valuable time over relatively unimportant conditions. It is, therefore, well to make this entire rapid inspection of the bowel even before closing any perforation that may be found. It is a very simple matter for an assistant to retain the location of these perforations outside the abdomen with sponges. The *method of closure of the perforation* is relatively unimportant, but should always be done with silk; catgut alone has been demonstrated on several occasions to be insufficient. A short double row of continuous Lembert sutures is all that is required, and can be very rapidly placed without elaboration. Excising the ulcer before suturing is an utterly useless and time-consuming procedure. It is a rare exception to find an ulcer of such size that the suture encroaches to an important degree upon the lumen of the gut; in such instances the suture must be placed with greater care. If there are several neighboring or confluent perforations, or the integrity of a considerable portion of the gut is severely impaired by deep ulcerations not yet perforated, it is wise to secure this portion of the intestine to the edge of the wound rather than consume time by resection or an elaborate method of suture, and to close the fistula subsequently. Having secured the perforation, if the condition of the patient permits, it is always wise to make a retrograde search of this last metre of the ileum for *deep ulcerations threatening perforation*. These can be recognized with considerable accuracy by the trained touch. Running the finger down over the bowel the dangerous areas are indicated by small, soft, circular places in the centre of a moderately large, thickened area. The sensation is readily acquired by post-mortem examination of an ulcerated ileum, in which the observation can be verified by subsequently opening the bowel. These areas when found should be reinforced by a running silk Lembert suture. The cæcum and appendix being immediately at hand, it is well to give them a passing inspection. One is scarcely justified, however, in removing the appendix unless it is seriously affected, and not in instances where it is "at all abnormal," as was recommended by Dr. Finney, in his article in the *Johns Hop-*

kins Hospital Reports. If no perforation has been found in the search so far instituted, it is inadvisable to make further examination of the intestinal tract, excepting, possibly, the sigmoid flexure, which is occasionally, though quite rarely, affected. Typhoid perforations in other locations are so extremely rare that one would lose many more patients in a prolonged intestinal search than in running the slight risk of having overlooked such a condition.

Irrigation of the abdominal cavity we feel should be somewhat prolonged and very thorough, even if there are no visible evidences of peritonitis or extravasation. The stimulating usefulness of hot irrigation has been even urged in explorations where no perforation has been found, but at the present time one hardly feels inclined to irrigate in such cases. In many instances this abdominal irrigation should be deferred until the inspection of the gut has been made, unless the inspection is seriously hindered by the amount or nature of the fluid present, in which case a rapid preliminary irrigation may be useful, the main irrigation, however, to be reserved until after the treatment of the bowel. Salt solution is possibly preferable to sterile water, but either one will do. It should be about 115° F., copious in amount. This, we feel, is best and most wisely accomplished through one or several irrigating tubes without removal of the intestines, and should be especially thorough in the region of the pelvis and lumbar fossæ. It is often well to irrigate the pelvis first, introducing a large rubber tube which will take up a large part of the return flow; in this way one will not infrequently avoid general dissemination of a large proportion of the abdominal fluid and fecal extravasation which very frequently settles to the pelvis. If extensive peritonitis is already present, one must treat this complicating incident as such, and that will vary greatly according to individual belief. We feel, however, that the extensive intestinal manipulation sometimes advised in such cases is of doubtful wisdom unless the condition of the patient is unusually favorable. We would feel inclined to rely on thorough and prolonged irrigation of the abdomen without removal of the intestines, as this is about all such patients can endure. In many instances, to properly accomplish this irrigation to the best advantage, we feel that a general anæsthetic is advisable, although it is occasionally satisfactorily accomplished under local anæsthesia.

It may seem occasionally wise to close these cases without *drainage*, but such has certainly been felt to be the rare exception. It is possible that having the temerity to close these cases after thorough irrigation may add considerably to the recovery rate; such cases, however, should certainly be restricted to those in which examination of the abdominal fluid during the operation shows the absence of organisms, or, possibly, those in which only bacilli are found to be present; but

the advisability of drainage is scarcely questioned at the present time. The way in which one drains will vary according to the operator's personal belief. Whatever the method, however, it seems advisable to drain the pelvis. In the Lakeside cases what proved to be a very satisfactory method was by means of glass drainage tubes leading to the pelvis, and along the side of the tubes in some instances gauze drainage was also placed. It seems wise, also, to leave the seat of perforation or doubtful portions of the bowel near the incision, introducing gauze drainage to this portion of the bowel in order, if possible, to forestall the disastrous consequences of insecure suture or subsequent perforation. Around the drainage the wound should be closed as completely as possible, as the granulating capacity of such patients is sometimes considerably reduced, although the healing of wounds by first intention seems to be rapid and secure.

While it is needless to say that the operation should be done as rapidly as possible, it must still be remembered that *these patients bear operation* much better than one would ordinarily be led to suppose who had not had the opportunity for personal observation. The incision, the search for perforation, the repair of the bowel, can all be very rapidly and at the same time thoroughly performed, so that this portion of the operation may well be considered the minor part. The careful and thorough irrigation, however, is a matter that cannot be unduly hurried, although here the time can be somewhat diminished by having several irrigating tubes in use at the same time. This portion of the operation, while possibly consuming the most time, is the least depressing to the patient, as it is associated with a considerable degree of stimulation. We fear not a few cases are sacrificed through lack of proper irrigation, owing to the overwhelming desire of operators to complete the operation in as short a time as possible. We would urge the desirability of the utmost speed during the really operative part of the procedure, which is easily possible for any operator of moderate dexterity and good judgment, but would deprecate hurried and inadequate cleansing of the abdominal cavity. The superior ease and rapidity with which one can accomplish the operation under a general anæsthetic is often in marked contrast to the slow, painstaking procedure not infrequently required under local anæsthesia where the sensibilities of the patient are so keenly alive to what is going on, and this consideration, as previously mentioned, will not infrequently incline the operator to the use of general anæsthesia as of marked advantage.

The *subsequent treatment* of these cases presents nothing distinctive or striking, it only being necessary to keep in mind the requirements of the patient from the standpoint of a laparotomy on the one hand and that of typhoid infection on the other. While we do not mean to sug-

gest that the treatment of such cases does not require the greatest care and judgment, it presents no distinctive feature which need be dwelt upon. One thing, however, is extremely desirable, namely, to keep constantly in mind the possibility of a subsequent perforation, and avoid as far as one is able the possibility of obscuring the manifestations of this occurrence in any way by the line of treatment.

The question of *exploratory incision* in rather doubtful cases of suspected perforation we feel is a matter of great importance and increasing interest. This has been most advantageously urged and considered by Dr. H. W. Cushing, and is, we feel, his most useful contribution to the surgery of these cases. It has been exceptionally well expressed in his article, "Sur la Laparotomie Exploratrice Précoce dans la Perforation Intestinale au cours de la Fièvre Typhoide," *Archives Générales de Médecine*, January, 1901. In instances where perforation is suspected, but the diagnosis cannot be considered as definitely made, exploration affords the only hope of avoiding the catastrophe of allowing a perforation to go unrecognized until more or less general infection has occurred. Even at the present time it has been proven beyond a reasonable question that these operations when properly performed are practically devoid of danger and affect the condition and course of the patient to a scarcely appreciable degree, whether performed under local or light and rapid general anæsthesia. If no perforation is found the abdomen can be immediately closed, a collodion dressing applied and the baths resumed within a few hours, so that treatment of the patient need scarcely be interrupted. Such was the case in No. 4 of the Lakeside series. The impervious dressing necessary for continued tubbing is conveniently applied by using six or eight alternate layers of collodion and sheet wadding, each layer being a little larger than the one previously applied. It is well to use only half of the thickness of the ordinary sheet wadding.

Exploration was first suggested by Dr. Finney, who advised making a very minute incision for the purpose of taking cultures from the abdominal cavity. This method was employed in the Lakeside case mentioned, but the restricted nature of this exploration was considered a mistake, and can certainly be no longer recommended. One must now be able to detect more than the presence of free abdominal fluid or organisms within the abdominal cavity. The perforation may be protected by adhesions or the ulceration may be scarcely through the peritoneum, either of which conditions may occur without being discovered by such restricted exploration. If one is to look at all he should examine the ileum and cæcum with care; it will take scarcely more time and will afford information of consequence. It must be readily admitted that the very slight danger incident to a rapid, skilful exploration is not to be compared with the serious consequences of an

unrecognized perforation. Considering this as an aid to diagnosis, it is largely along this line that we are to look for a considerably larger percentage of recoveries from perforation. It will necessarily result occasionally in a premature operation, but will add very materially to the number of lives saved.

In instances where no perforation is found, either with or without evidences of peritoneal infection, at once arises the question of how far one may feel justified in exploring the abdomen for such *other intra-abdominal conditions* as have been known to suggest perforation. This is a matter which will be decided entirely by the individual judgment of the operator, and must be affected to a greater or less degree by the condition of the patient. Where, however, one finds an abnormal intra-abdominal condition, as peritonitis, for instance, it seems hardly justifiable to limit the search for the seat of the trouble to a rapid glance at the ileum and cæcum. The appendix is so close at hand that its inspection should never be omitted. The detection of suppurating mesenteric glands is important for the sake of adequate disposition of drainage. Exploration of the region of the gall-bladder may be accomplished without serious objection. The presence of intestinal obstruction may possibly be detected by a hurried examination of the intestine from several parts of the abdomen. Unless the indications are pretty direct, however, one would scarcely feel inclined to risk much time on this very remote possibility. The extent to which these explorations are to be pushed is a matter for much thoughtful consideration.

The advisability of *secondary operation* for subsequent perforation or other operative indications is no longer a matter of general question, but of individual judgment in each case. The remarkable vitality displayed in a number of reported cases in which two or more subsequent operations were performed, has established this point beyond reasonable question. Operative indications are to be followed, and can no longer be set aside, for the simple reason that the patient has already undergone one operation.

Prognosis. At the present time it is extremely difficult to form even a reasonable idea of the prognosis in these cases. We know that it is affected by a number of conditions. In general, the recovery rate is higher among young people. The time during the disease at which perforation occurs has an influence, since the recuperative powers of the individual are altered at different times. Recovery is less frequently to be expected when perforation occurs during the height and severity of the disease, whether of a primary attack or in the midst of a severe recurrence. When perforation occurs early in the disease, before the vitality of the patient has been drawn upon to any considerable degree, the prognosis in general is better, and also during conval-

escence after the recuperative powers of the individual have begun to assert an advantage. The prognosis is always severely affected, of course, by the length of time the case has been allowed to go after perforation, the extent to which a spreading abdominal infection has occurred, and the bacterial nature of this infection. It is also largely affected by the judgment, skill, and dexterity of the operator. But when it comes to an estimation of the percentage of recoveries the figures obtainable from the present statistics are, we believe, absolutely unreliable. In Dr. Westcott's table, comprising the first 83 cases reported, the recovery rate was 19.3 per cent., while in Dr. Tinker's table, comprising, presumably, the next 75 cases reported, the recovery rate was 28 per cent., making an average recovery rate for the entire 158 cases of 23.41 per cent. This recovery rate is far below that obtainable under the present conditions of diagnosis and operative technique; but the prognostic suggestions afforded by even the most recent cases which the writer has carefully collected are, we feel, too inaccurate and undiscriminating to deserve mention. This analysis affords a certain percentage of deaths associated with operation, to be sure, but many of the cases dying after operation bear no relation whatsoever to the true mortality in direct connection with either the perforation itself or the operation. This last statement has been most satisfactorily demonstrated by several post-mortem examinations in the Lakeside series. With but rare exceptions it has been impossible to draw this distinction in our study of recent cases owing to the incompleteness of the reports, but we are sure such a discrimination would alter materially our statistical mortality. Dr. Osler has divided these cases into three classes: those which recover from operation, those which die from causes immediately related to perforation and operation, and those which die from causes entirely unrelated to either. It is of the utmost importance that this distinction be kept closely in mind in forming an estimate of the mortality in these operations, but it is a distinction which, curiously enough, seems to have almost entirely escaped the thought of those attempting to form a statistical opinion of recovery and mortality. It is absolutely impossible to acquire the knowledge necessary to form this more accurate opinion without wide and accurate pathological observation and careful post-mortem examinations. An attempt was made by the writer to form such an estimate from the number of autopsies reported, but the number at present is so small and the reports are so fragmentary and inaccurate that the analysis has proved utterly worthless. Unless the operators under whose observation these cases are occurring can contribute generously to our pathological knowledge, any further reports are practically useless and might much better be omitted, since superficial reports only burden the literature without contributing to our present knowl-

edge. Dr. Keen estimates that we can look forward to 30 per cent. of recoveries. The recovery rate at the Johns Hopkins Hospital of cases occurring while under treatment in the wards is 45.4 per cent. Dr. Osler estimated a possible recovery rate of 50 per cent., and Dr. Cushing of 50 to 60 per cent. We cannot but believe that a discriminating analysis in well-observed cases with complete pathological examinations would give a recovery rate considerably in excess of this, possibly 70 per cent.

Pathological Considerations. The *nature of the abdominal infection* in these cases is purely fortuitous, being drawn from the wealth of bacterial flora of the ileum, the possibilities of which have probably never yet been exhausted. The proportion of cases in which bacterial examination of the abdominal fluid has been made is very small, but such examinations have been more frequent in recent cases as their usefulness and prognostic value have become more evident. The infections as a rule, however, appear to be mild, largely bacillary, bacillus coli communis and bacillus mucosus capsulatus being the most frequent. One strange incident of a pure infection of staphylococcus pyogenes aureus has been reported. Some half-dozen cases of infection with bacillus typhosus have been collected, from which it appears that these cases are attended with a high mortality. It will be necessary, however, to have a large number of cases in which a complete and careful bacterial examination has been made to give these results anything more than a passing interest. It is very desirable that our knowledge of the nature of these infections be widely increased, as it may eventually be found that certain features in the treatment can be altered to advantage according to the nature of the infection. It is possible that certain infections which are recognizable from cover-slip examinations will require very much less thorough irrigation, for instance, and that in some cases we are at present subjecting the patient to a considerably more severe strain than the circumstances may require. Cover-slips and cultures should be freely taken, and as these procedures require but a moment they need scarcely interfere with the rapidity of the operation. These examinations should be made not only from the fluid first encountered on opening the abdomen, but also from the lower and more dependent levels, as it sometimes happens that the upper part of the abdominal fluid appears to be free from organisms, and one is led to the erroneous conclusion that no bacterial infection has occurred. It is very desirable, also, to make an examination from the site of the perforation itself, and this, of course, is especially necessary in early cases where no appreciable amount of abdominal fluid is present.

It has been thoroughly demonstrated pathologically, and in several instances has apparently been clinically confirmed, that *infection of*

the peritoneal cavity may occur through the base of an ulcer without perforation, or even through the inflamed portion of the intestine itself without deep ulceration. Such a case was reported by Dr. Ioison, "Du Traitement du Chirurgie de la Péritonite Suppurèe Diffuse," *Revue de Chirurgie*, February 10, 1901, No. 2, where no solution in continuity of the bowel was found either at operation or autopsy. It is extremely probable, also, that such was the condition in the case of Dr. Dandridge, No. 28 of the Westcott series, in which no perforation was found, but the abdomen contained gas and free pus. The patient was irrigated and drained, and recovery followed. Such instances, however, are quite unusual, and it is hardly safe to assume that the case is of this variety, simply because no perforation is found in the rapid search of the ileum. It is, we feel, rather safer to assume that infection has occurred from some other source, which should be found and corrected as circumstances may permit.

It is probable that *adhesions* more or less extensive occur in all of these cases and that the infrequency with which they are reported is due to inaccurate observation necessitated by a very restricted incision through which the bowel has been drawn before the examination was made. As mentioned above, this procedure does not seem wise, since adhesions forming a perfect protection for the peritoneal cavity against infection may be blindly broken up and the opportunity offered for general infection. It is not meant in recommending a rather more generous incision that there is a necessity for actual visual observation of the entire field, but that by this means sufficient care can be exercised in the withdrawal of intestine to prevent fecal extravasation and infection where such has not yet occurred. In cases of what appear to be sudden perforation it is doubtful if these adhesions are of sufficient consequence to afford much protection. In the Lakeside cases, while no adhesions were found in those operated upon for perforation itself, it was probably true that they were overlooked through insufficient care in the search for the lesion.

With reference to the *great practical value of complete postmortem examinations* in these cases, too much cannot be said. The greatest interest thus far seems to have centred in reporting certain clinical features and the circumstances of recovery, and from the small number and paucity of the postmortem examinations it is evident that very little interest has been taken in this part of the subject. It is perfectly useless to continue reporting simple recoveries for the sake of apparently increasing the recovery rate. What is most essential at the present time is a large collection of well-observed and well-reported autopsies. A complete examination, however, does not necessarily mean a complete autopsy. Through even a restricted incision it is possible to gain a fairly accurate conception of the extent and nature of

the peritoneal infection if present; the appearance of the bowel for the sake of comparison with that observed at operation; the presence of additional perforations, overlooked or subsequent, and the existence of threatening perforations; the degree of success with which the suturing has been accomplished, and other respects in which the operative technique has been unsuccessful. Cultures may also be widely taken through such an incision, and the spleen, heart, and lungs examined. Blood cultures should also be taken. It is only in this way that we are going to be able to arrive at some definite conclusions as to the cause of death in these cases and the respects in which the treatment has been unsuccessful, and it is only by these means that the mistakes that are constantly being made in every case of perforation, either in diagnosis or treatment, can be rectified. For the sake of the present patients the clinical features and the operation are of sole consequence; the interest of future patients, for the present at least, lies almost entirely in pathological examinations.

In the apparent hope of giving some general direction to the clinical features of these cases, Dr. Osler has published the specific instructions which are followed in the medical wards at the Johns Hopkins Hospital, "Perforation and Perforative Peritonitis in Typhoid Fever," *Philadelphia Medical Journal*, January 19, 1901, vol. vii. p. 116. This is as admirable a schedule as can well be imagined, and could most profitably be adopted for the sake of complete and uniform observation. To this schedule we would feel inclined, from an operative and pathological standpoint, to add certain suggestions which may be an aid in determining with more accuracy some of the unrecognized features mentioned in connection with these cases. Doubtful clinical features of so much consequence in establishing the all-important early diagnosis are covered by the Hopkins schedule. For the sake of a general and more accurate idea of the amount of systemic depression associated with the anæsthetic, the operation, or both, it is well to note with as minute accuracy as possible the condition of the patient immediately before and immediately following operation, as well as the changes in his condition for at least twenty-four hours subsequent to the operation. In taking cover-slips and cultures these should be obtained from various parts of the abdomen and also from the upper and lower portions of the abdominal fluid if present, and from the site of perforation. It is desirable to note with much care the general condition of the bowel, the nature and extent of adhesions, and the extent and severity of the general infection if present, for the sake of comparison with post-mortem examination in case the patient does not recover. In the post-mortem examinations, whether complete or restricted, the condition of the bowel and the extent of infection should be carefully noted; cover-slips and cultures should be widely taken

from the abdomen, organs, and blood; the condition of the operative field in the bowel should be carefully observed, also the presence of additional perforations, either those overlooked during the operation or those apparently subsequent to the operation, and the presence of threatening perforations. These are all points of special consequence, which, it is believed, will lead to an accumulation of facts of much practical value if carefully and generally observed. It is necessary to make so many of these post-mortem examinations without the direction of a trained pathologist that the circumstance seems to justify the mention of these details. It is from well-equipped hospitals that we must first look for such a class of reports, as elsewhere it is scarcely possible to have both medical and surgical observation of all typhoid cases, and especially of all suspicious cases. A means which will add very materially to the unity and usefulness of these observations and reports, and which will tend to develop a degree of judgment in diagnosis and operation that cannot possibly be obtained in any other way, may be afforded by having all these cases brought under the immediate control of one member of the hospital staff. The number of perforations occurring during a year in any one institution is not large, and if the opportunities for observation and treatment are divided among a number of men the experience gained by each is very limited, the observations are very apt to be restricted and unmethodical, and the combined judgment rather biased and uncertain according to the nature of the particular case or two which has come to the hand of any one man. We feel that if this suggestion could be carried out our knowledge of this subject would be widely, rapidly, and very beneficially increased.

While, however, it is true that a large portion of these operations will still be done in hospitals, mainly on account of the difficulties in diagnosis, it is still interesting to note that there has been reported by a general practitioner one successful case in a country house under the conditions which one finds there ordinarily existent. The case was reported by Dr. R. T. Davis, "Perforation in Typhoid Fever; Operation; Recovery," *American Medicine*, January 18, 1902, vol. iii. p. 116. The operation was performed only six hours after perforation was thought to have occurred, which betokens a degree of watchfulness that one can scarcely hope to obtain with much frequency under such conditions. As this is the first case of its kind reported it is of special interest in showing the changing attitude of the medical profession in general with reference to perforation during the course of typhoid fever.

SOME PHASES OF GALLSTONE DISEASE, WITH SPECIAL REFERENCE TO DIAGNOSIS AND TREATMENT.

By D. D. Stewart, M.D.,
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The dominant factor in the formation of gallstones apparently is bacterial invasion of the gall-bladder plus a tendency to stagnation of the bile in that viscus. It was formerly thought, since normal bile is usually sterile, bacteria could not thrive in that fluid; but it is now established that bile is a fertile culture medium for many varieties of pathogenic bacteria, notably the Eberth bacillus and the colon bacillus and its varieties, which may assume pathogenic properties.

The bacteria most commonly found in connection with cholecystitis and gallstone formation are the colon and typhoid bacillus, and, less commonly, the gall-bladder is invaded by streptococci, staphylococci, and the pneumococcus.[1]

The invasion of the gall-bladder by bacteria occurs either by the blood (portal vein, thence eliminated by the liver in the bile), the likely mode of the almost invariable infection of the gall-bladder in typhoid fever, or through the duodenum by means of the common bile duct and the cystic duct, the probable source of colon bacillus infection.

With the latter mode of entry the infection may and often is a mixed one, since the healthy duodenum is said to normally harbor not only the colon organism, but also staphylococci and streptococci. It seems established, as just remarked, that in nearly all, if not in all, cases of typhoid fever infection of the bile by the specific microorganism occurs. It is interesting, such being the case, that in only a limited number of these does cholecystitis immediately or subsequently develop, or are pathological changes in the walls of the gall-bladder found in cases of lethal typhoid.

Bacteria do not normally readily migrate into the bile passages from the intestines, and the pathological condition which favors their entrance is somewhat similar to that which favors, by their aid, gallstone formation—stagnation in the outflow of bile through the ducts. Obtaining an entrance into the gall-bladder, these organisms probably lead to the formation of gallstones in the manner originally suggested by Naunyn, by inducing a catarrh of the gall-bladder through infection of its wall; or even without such an infection the formation of

[1] For details of this part of the subject the reader is referred to the article by Pratt, Typhoid Cholecystitis, with Observations upon Gallstone Formations, The American Journal of the Medical Sciences, November, 1891; and that of Richardson on the Bacteriology of the Gall-bladder, in Warren's Surgical Pathology and Therapeutics.

calculi may be promptly favored by virtue of the acid production of such organisms as the Eberth and the colon bacillus. This acid production leads to precipitation of bile acids and of cholesterin. Stagnation of bile occurs in the gall-bladder, whence result concentration, and subsequently, through cholesterin, bile acids, and bilirubin-calcium precipitation, stone formation is readily induced.[1]

Micro-organisms have been found in many instances of fairly recent stone formations in the very centre of the stone, as if they had been an original portion of the nidus; and in gallstone formation in recent subjects of typhoid fever experimental evidence indicates that the Eberth bacilli, clumping in the gall-bladder, may offer nidi for precipitation of cholesterin and other products entering into the composition of biliary calculi.

A cholecystitis recognizable other than by minute pathological changes in the wall of the gall-bladder is not an essential factor in gallstone formation.

Cholecystitis is more common in women than in men, and is still more usual in childbearing women (of 115 women gallstone subjects, 99 had borne children—Naunyn). The frequency of the affection increases with age. This preponderance of frequency is evidently related to increased bile stasis, resulting from the relatively less respiratory activity in woman than in man, in the pregnant woman than in the nullipara, and in the aged than in the young.

Cholelithiasis is a very common condition. Riedel (quoted by Kehr) holds that in Germany nearly 10 per cent. of the adult population are gallstone subjects. This percentage is probably much greater than exists in Great Britain or in the United States. It is interesting and important that but a relatively very small percentage of those with galistones ever have symptoms suggesting their presence. Kehr believes that approximately 95 per cent. remain free from symptoms; but this estimation is probably much too high, as many cases of minor transient and infrequent attacks of colic due to mild cholecystitis occur in those who never consult the physician or in whom these transient colics are wrongly diagnosed. However this may be, this infrequence of symptoms is a suggestive fact and indicates what seems now well established, that something other than mechanical irritation of the stone is required to induce the symptoms whereby the presence of calculi is recognized.

Cholelithiasis is usually latent until a reinfection of the gall-bladder determines the condition manifesting its presence.[2] If, with stone

[1] Frerichs long ago held that gallstones originated as the result of bile stagnation, the mucus secreted by the gall-bladder favoring an acid reaction of the bile, with consequent precipitation of its salts. He was, of course, unaware of the rôle bacteria played in the formation of calculi.

[2] Cholecystitis may occur primarily without the presence of stone, as in the acute infection of the gall-bladder in typhoid fever and in pneumonia.

formation, the infection of the gall-bladder has not given rise to other than minor and transient pathological changes in the walls of this viscus, and adhesions are absent and the cystic duct patent, only in exceptional cases is it likely that attempted extrusion of a stone occurs. Symptoms incident to the latter commonly originate from a cholecystitis dependent upon reinfection, either newly acquired or from a pathogenic micro-organism, long latent in the gall-bladder, perhaps the original source of the calculi. There are many instances on record of typhoid cholecystitis occurring primarily a number of years after the original attack of typhoid fever.

While mechanical irritation of the stone itself rarely originates biliary colic, it is, of course, probable that in conditions favoring stagnation of bile in the gall-bladder and prolonged distention of that viscus, such as would be induced by muscular inactivity and fasting, that transient colics occur in gallstone subjects, without a coincident cholecystitis. Usually frank attacks, or those of mild, ephemeral nature, if tending to recur, indicate infection of the gall-bladder, with its resulting inflammation. The symptoms of recognizable cholelithiasis are, therefore, usually those of cholecystitis or one or more of the latter's complications, such as pericholecystitis (adhesions), obstruction of the common bile duct, or cholangitis.

The most common form of cholelithiasis encountered is that associated with catarrhal inflammation of the gall-bladder, the result usually of a moderate grade of infection. In this there is often an abortive attempt at passage of a stone, and the stone may engage the neck of the gall-bladder or lodge in the cystic duct. The infection is transient and its degree mild. There may occur a so-called dropsy of the gall-bladder of either minor or major degree, but ephemeral almost in duration, if obstruction of the duct by a stone does not exist. In any event, with infection of mild degree and transient, the symptoms are of brief duration unless the calculus passes into the common duct, and there lodging, temporarily or permanently, by interfering with the outflow of bile, causes the usual phenomena of obstruction with jaundice. This last is the form of gallstone colic alone usually recognized by the general practitioner. With a high grade of infection, and either with or without a patent cystic duct, empyema of the gall-bladder may develop either immediately or subsequent to simple dropsy of its cavity. Empyema may occur coincident with a primary attack of hepatic colic, or after repeated seizures, with more or less long intervals of repose. If the calculus has entered the common duct, the infection continuing, there may result diffuse inflammation of the smaller bile ducts, or cholangitis.

A frequent accompaniment of repeated attacks of calculous cholecystitis, is pericholecystitis, resulting in the formation of adhesions

between the gall-bladder and contiguous structures, such as the omentum, stomach, or intestines.

Apart from perforation of a gall-bladder the seat of a recent empyema with frank symptoms, a not rare effect of latent cholelithiasis with adhesions, is perforation of the gall-bladder or of one of the bile ducts harboring a calculus, with passage of the latter into a contiguous adherent organ, such as the bowel or stomach, the first recognized indication of gallstone being the voiding of the calculus by the bowel or an obstruction of the lower part of the ileum by the stone too large to pass the ileocæcal valve.

As a more remote but not uncommon effect of gallstone disease there may result dilatation of the stomach from adhesions about the pylorus or duodenum constricting its outlet; recurring gall-bladder colics even without presence of stone from similar adhesions, and gastralgia and enteralgia similarly arising. In addition to the numerous ill effects from adhesions, other not unusual remote results of gallstone disease are carcinoma of the gall-bladder, or of the common duct, or of the head of the pancreas. Hepatic cirrhosis from continued occlusion of the common duct, interstitial pancreatitis and acute hemorrhagic pancreatitis, and pancreatic fat necrosis are among the complications or more remote effects.

Catarrhal calculous cholecystitis is not only very common, but, as before remarked, is frequently improperly diagnosed. My attention was first forcibly directed to this fact long ago by some remarks of Jonathan Hutchinson.[1] In then discussing a paper by Dr. Ord concerning the more rare symptoms produced by gallstones, Mr. Hutchinson referred especially to these slight passing attacks of colic which were commonly regarded to result from stomach disorder, but in reality were due to spasm not of the stomach, but of the gall-bladder. He spoke of the importance of an inquiry for a history of such attacks in the past in arriving at a diagnosis, when later in the case more pronounced symptoms suggestive of the presence of gallstones occurred. He dwelt on the necessity of careful inquiry for symptoms which may have been regarded as too trivial to mention, and on the necessity for examination of the gall-bladder region, and emphasized the mistake so often committed by the physician in viewing jaundice as essential to the diagnosis of cholecystitis. He remarked: "Hepatic colic is a far more common event than it is generally supposed to be, and many cases escape recognition because there is a general belief that jaundice ought to be present."

This statement of Hutchinson impressed me very forcibly at the time of its publication, and caused me to be on the alert for such cases,

[1] British Medical Journal, June 30, 1888.

and in the past fourteen years has been very helpful in their recognition. I have seen many that might have been viewed as simple gastralgia and as cases of recurring gastritis that were unquestionably calculous cystitis. Certain of these cases have been of a very mild type; there has been little or no rise in temperature noted, and the colic recurring irregularly at intervals of a few days is unassociated with a palpable gall-bladder. The pains, too, are often referred solely to the epigastrium, but examination may show the gall-bladder region to be acutely sensitive during the seizure, with frequently a continuance of the sensitiveness in less degree for some time after. It is especially important to be on the watch for such cases, since in certain of them in which obstruction of the duct has occurred, with resulting hydrops, empyema of the gall-bladder may develop very insidiously.

A case of mild recurring, probably calculous, cholecystitis is now under observation in a woman, aged thirty-six years, who, apart from attacks of what she presumed to be stomach spasm, has always been in good health. The first attack occurred four years ago, and, she thought, had been induced by eating when over-fatigued. The second attack occurred seven months later, and following this they recurred about twice a year until two years ago; then their frequency increased, a seizure appearing at intervals of two or three weeks, until I saw her one year ago. The attacks occur suddenly without premonitory warnings, and bear no definite relation to the time of meals or character of food eaten. Severe pain appears in the centre of the epigastrium and to the right. The seizures have occurred through the night on three occasions only. She thought they were more usual before the menstrual period.[1] There are no special dyspeptic symptoms save, following the attacks, flatulency. The tongue is clean and the bowels regular. Vomiting is not unusual before the seizure. The attack often lasts an hour or two, and is dissipated by hot applications and the ingestion of cajuput oil in spirits of chloroform. The patient is of full habit and is very fond of sweets, and takes little exercise. Examination showed slight gastroptosis; gastric motility normal; diminished secretory activity. Examinations in the intervals disclosed slightly palpable, sensitive gall-bladder; no sensitiveness elsewhere in the abdomen. Palpation of the gall-bladder region, although carefully done, was followed by extreme soreness persisting for several days. The patient was subsequently seen once during a seizure when, although the gall-bladder was not palpable, there was marked tenderness in this region. This patient had been treated for simple gastralgia until I saw her. Stones probably at no time were voided; the attacks were of too short duration to suggest this, and jaundice has never occurred. The patient has had no seizure since the first few months of treatment. Gallstones were persistently searched for in the stools.

An interesting case recently seen of dropsy of the gall-bladder is the following: Mrs. H. H. S., aged fifty years. In September, 1901,

[1] It is a fact that the occurrence of pains of this sort is more common at this time, probably for the reason that, as mentioned by Kehr, the portal viscera, then more surcharged with blood, are more subject to inflammatory reaction.

the patient, while driving, was seized with severe epigastric pain and vomiting. The pain continued irregularly for two or three days. Some six days after the appearance of the attack I was summoned to see her. There had been no colicky pain for several days, and there remained merely a sensation of "soreness" in the epigastrium and right hypochondrium. Her stomach had been much disturbed by the remedies previously employed, and there was persistent nausea, with fetid breath and foul tongue. Although there had been a febrile reaction, the temperature now did not exceed 100° F. Examination disclosed a readily palpable and large (reaching to the umbilical line) but not hard gall-bladder, very little sensitive to pressure. It was interesting that there had been two similar though much briefer attacks occurring about six months apart some ten years before. The patient could not recall the occurrence of pain from that time until the present. Jaundice was absent in these as in the present attack. Here there was an undoubted acute hydrops of the gall-bladder, with stone probably engaging the cystic duct. The case was under constant observation for two weeks, when, but little diminution in the size of the tumor occurring, I had Dr. Neilson see her, with a view to operation. Consent of the patient was first given, but subsequently withdrawn. At the end of the third week the gall-bladder had diminished to about one-half its original mass, but was still easily palpable. She then was no longer under treatment.

In this case, as remarked, the cystic duct is probably still obstructed by a stone. The infection originating the acute seizure was evidently slight, leaving a simple dropsy of the gall-bladder. If I am right in my surmise concerning the presence of stone in the cystic duct, a cholecystotomy should have been done. This I persistently urged, resultlessly. On inquiry at this writing about her condition, the patient, who had not previously been seen for about a year, informs me that she has remained free from recurrence of colic and regards herself in perfect health; but she states it is not unusual to be conscious of a sensation of weight and discomfort in the region of the gall-bladder. An examination at this writing shows resistance and fulness here; and although, because of a recent increase in abdominal plethora, the gall-bladder cannot be palpated with distinctness, it is evidently still somewhat enlarged. I regard it probable that there are adhesions about it which later will cause trouble.

I have seen many cases similar to the two foregoing, and cite them as specimens of a class.

Two weeks ago a physician brought to me a man whom he presumed to be suffering with recurring attacks of simple gastritis. There were seizures lasting upward of a week or two, in which there were present epigastric pain and vomiting, with intervals of freedom from more than slight pain, but with present gastric irritability for several months. The patient was brought in the interval, and advice desired because of the irritable stomach. As jaundice had never been present, cholecystitis had not been suspected. An examination showed acute sensitiveness in the gall-bladder region and in no other situation. The gall-bladder could not be palpated because of the muscular rigidity

and tenderness. Careful inquiry elicited the fact that the pains were as severe in the right hypochondrium as in the epigastrium. The case was clearly cholecystitis such as demanded surgical interference. The patient was immediately sent to Dr. Deaver, who acquiesced in the necessity for operation, but the patient's consent could not be obtained.

The following strikingly interesting case shows with what few symptoms calculous cholecystitis may develop and continue despite the presence of a chronically very large gall-bladder and stones in the cystic duct:

In May, 1898, I saw, with Dr. Pottberg, a woman, aged seventy years, who complained merely of a dragging sensation in the right side. Dr. Pottberg had noted the presence of a tumor, but was uncertain as to its nature, because of the absence of symptoms. The patient was otherwise in perfect health and without any indications of senility. It was only on close questioning and with difficulty she recalled that several years before she had had at short intervals a few slight attacks of what she regarded as "stomach cramp," for which she had not consulted a physician. Jaundice had never occurred. Examination disclosed a very large and apparently unadherent and but little sensitive tumor, which was plainly the gall-bladder. It caused inconvenience merely by its weight. The diagnosis was chronic obstruction of the cystic duct by stone, with the presence, presumably, of many calculi in the gall-bladder. Immediate operation was advised. This was performed by Drs. T. R. Neilson and H. C. Deaver, at the Episcopal Hospital. Section disclosed a very large and unadherent gall-bladder. It contained over one hundred stones and a great quantity of mucoid material. Two good-sized stones tightly engaged the cystic duct. These were removed and excision of the gall-bladder practised. The patient made a prompt recovery and has been in good health to the present.

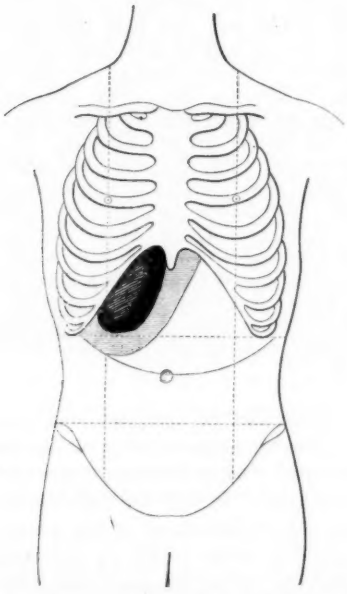
The diagnosis in cases like the foregoing, examples of simple calculous cholecystitis, is readily made if one is on the alert. The history of colicky pain associated with persistent or recurring sensitiveness in the gall-bladder region, even though the gall-bladder be not palpable, should at once lead to a conjecture as to the probable nature of the ailment. A cholecystitis when occurring primarily, apart from a general infection, is very apt to be associated with calculus. Occasionally a case is encountered in which the results of a pericholecystitis, probably following several acute seizures, suggest the notion of latent calculus, although no stone may be present. In such a case adhesions resulting from attachment to the omentum, duodenum, stomach, or colon are the cause of colic or at least of soreness and discomfort in the gall-bladder region. If the gall-bladder should be patent and kinking of its duct intermittently occur, colic may thus arise in the same manner as if a stone were temporarily obstructing the duct. In such cases calculi may have been present, but been voided. I have seen several

cases of this nature. In the following recently observed instance the diagnosis of adhesions was confirmed by operation. The case is a most instructive one.

In this case the presence of attacks of recurring slight colic, often associated with diarrhœa, of persistent sensitiveness in the region of the gall-bladder, of an ill-defined tumor and of interference with the gastric function, caused me to make a diagnosis of chronic cholecystitis with adhesions, probably to the duodenum. It was presumed the condition was dependent upon cholelithiasis.

L. W. T., aged forty-four years, consulted me in December, 1899. For the preceding four years his stomach had troubled him. Briefly

FIG. 1.



Deep shaded area, that of fulness, resistance, and of decided sensitiveness to pressure. Lightly shaded area that of diminished sensitiveness. The whole shaded area, region in which crampy pain is common.

the symptoms were: More or less discomfort at all times in the region of the stomach and right hypochondrium, especially manifest an hour or so after meals. It is more marked when in the erect posture, and is scarcely evident when lying down. No pyrosis; no flatulency. Bowels irregular, with a tendency to looseness, with pains in the gall-bladder region. These pains diffuse over the abdomen, and, following an attack of pain, diarrhœa lasting from a few hours to a day or so

may occur. Twenty years before he had had a liver trouble. Liver was then said to be enlarged; never jaundiced; no lues; no typhoid fever; hue of skin markedly sallow; no icterus; puffy lower lids; acneform eruption on face; area of fulness and sensitiveness in the gall-bladder region and below at the situation of the hepatic flexure of the colon. Situation of tenderness especially that of the gall-bladder region. Decided sensitiveness to deep pressure if extended under the costal margin. Sensitiveness diminished laterally, as is indicated in the shading in Fig. 1. Outline of liver normal. Spleen not palpable. Inferior border of the undistended stomach at umbilicus. Knee-jerks, station, and pupils normal. Several examinations of the stomach contents: Lowered motility; high total acidity, with subnormal HCl; impaired starch digestion. Blood examination: Leucocytes, 7200; red blood corpuscles, 4,350,000; hæmoglobin, 75 per cent. Urine: Specific gravity, 1020; trace of albumin; narrow hyaline casts; glucose absent. Diagnosis: Chronic cholecystitis with adhesions; chronic gastritis. Treatment: Diet regulated; systematic out-of-door (horseback) and breathing exercises. Daily morning stomach douches with hot and cold water, sodium bicarbonate in hot solution, and weak quassia infusion and sodium chloride in the cold. Lavage, succeeded three-quarters of an hour before breakfast by sodium phosphate and sodium sulphate, of each ½ to 1 drachm; sodium bicarbonate and salicylate, of each 10 grains. Nux vomica, nitrohydrochloric acid, and taraxacum before meals. After meals diastase, rhubarb, and ipecac. Priessnitz compress constantly worn; later, flying blisters to the gall-bladder region.

The general condition improved markedly under this treatment, but at the end of two and one-half months, sensitiveness and fulness in the gall-bladder region continuing, I had Dr. Keen operate. The gall-bladder was fixed by adhesions to the duodenum and colon; cystic duct patulous. The gall-bladder free from calculi; its walls thickened. When last seen, six months after the operation, local symptoms had not reappeared and the general health was good.

The case of Dr. Pottberg narrated above is unusual in paucity of symptoms and in freedom from ill effects, the result of the long-existing gall-bladder obstruction. The original infection causing the cystitis, which led to the passage of calculi into the cystic duct, was evidently of feeble intensity and short duration, and a re-infection of the gall-bladder was prevented by complete occlusion of the duct. I shall cite another case of cholecystitis in which the diagnosis was at first somewhat doubtful, the attacks simulating those of angina pectoris. Here there existed bad aortic and mitral disease with imperfect compensation, and chronic nephritis. Although calculous cholecystitis was early suspected, and later demonstrated by the recovery of stones from the passages, an operation which was suggested to the patient six months before it was performed was postponed, because of the risk involved by the bad heart condition. Operation was performed when it was feared that a rupture of the gall-bladder might ensue. This case is related in brief outline only.

Mrs. M. D., aged forty-seven years; first seen in June, 1900. Patient confined to bed. She was then in the midst of a severe anginal seizure. There was substernal and infrasternal pain; marked cyanosis, urgent dyspnœa; very irregular heart, with similarly irregular but high pressure, slow pulse; marked aortic regurgitant murmur and presystolic and systolic (transmitted) mitral murmur. Cardiac enlargement. The liver was much enlarged; the conjunctiva slightly icteroid; albumin and casts in the urine. Apart from the severe pains above mentioned, there were attacks of crampy pain in the centre of the epigastrium, but not then in the hypochondrium. These lasted an hour or two and were associated with diarrhœa. These were not manifest when she was first under observation. The seizures were at first regarded as anginal in character, dependent upon the aortic valve disease, and this notion was borne out by the improvement and marked diminution of attacks under cardiac medicaments. Tumor of the gall-bladder was not apparent until November following, five months after she came under observation in the seizure occurring just before operation, and no marked sensitiveness in the gall-bladder region was at first evident. This had on a number of occasions been searched for, as it was suspected in the early summer that cholelithiasis was a factor in the production of the attacks. The feces were from the first sieved at intervals through the summer and autumn, but no stones were found until November. She was seen in only three attacks, two such as described above, the third in November. In this, associated with the presumed anginal pain, there was pronounced hepatic colic. The gall-bladder was then found much enlarged, and highly sensitive. Jaundice other than icteroid conjunctivæ was absent. Rigors and fever existed with the seizure. I feared an empyema of the gall-bladder and urged the necessity of immediate operation. Operation by Dr. Keen, November 18, 1900. The gall-bladder although much enlarged, contained but fifteen calculi—a few very large and a number quite small. It was distended with a mucoid material and the walls looked as if in a condition of slough. The patient, although very ill after operation, finally recovered. Despite the condition of the heart and kidneys, which render her a permanent invalid, there has been no recurrence of what were first thought to be anginal attacks.

The preceding cases, excluding that of the pericystic adhesions without stone—mentioned to show a later phase of the disease—are common examples of the calculous affection, but such as are not seldom undiagnosed by the general physician. In these cases without obstruction of the common duct jaundice is naturally wanting. Should icterus of minor grade develop—wholly unnecessary to the cholecystitis itself, however, many stones may engage the cystic duct—it is originated by the infectious process invading the common duct or the hepatic ducts and the smaller biliary channels, thus developing a catarrhal cholangitis. It is a matter of common experience in consultation, although the reason for the absence of jaundice is obvious, to be met by the query, if it is a case of gallstone, Why in all this time has not jaundice appeared? So, too, the impression often exists that the occurrence

of very severe pain is an essential factor in the passage of a stone, and of continued suffering with its lodgement. That it commonly is, there is no question, and no greater acute pain in any ailment may be experienced than by the passage of a good-sized calculus through the spiral cystic duct and finally through the papilla of the common duct into the duodenum.[1] It is these cases which are the rule in which jaundice and pain are so prominent that lead to the non-recognition of the exceptions. A stone may be of fair size and be lodged for some time in the common duct, yet from its shape and from the absence of inflammation about it, allow fair passage of bile onward into the bowel, the obstruction, if any, being intermittent; then a slight discoloration of the conjunctivæ only may be present. Usually, however, jaundice of high grade follows in a few days the impaction of a stone in the common duct, which jaundice may lessen and increase as the flow of bile is alternately completely stopped and again partially established, until the stone reaches the termination of the common duct, and finally entirely and more or less permanently occludes it. It is thus usual to find considerable variation in the amount of icterus with obstruction of the common duct by calculus, unlike the case with obstruction from without as by a tumor (carcinomatous growth of the gall-bladder and of the glands of the portal fissure, or of the head of the pancreas). Here, too, another point of importance should be spoken of in the recognition of these cases of calculous obstruction of the common duct, of value in differentiating them from obstructions arising from the presence of a new-growth or pressure by carcinomatous glands. In long-continued obstructions from stone, the gall-bladder commonly, though enlarged originally, finally, by virtue of the chronic inflammatory thickening of its wall, becomes undistensible, shrinks, and is unpalpable; while in obstruction of the duct from pressure by a growth a gall-bladder tumor is usual.[2] This, which has been termed the law of Courvoisier, although it must not be depended upon invariably, is of value in diagnosis, as is shown in the following case. This case, in which the diagnosis was confirmed by operation, also illustrates one of the vagaries of cholelithiasis. It is one in which, with obstruction of the common duct by a massive, tightly adherent calculus, little preceding history of colic could be obtained. The stone was finally borne without pain, and jaundice and debility almost alone, after a few weeks of colic, indicated to the patient the presence of her illness.

Miss D. B., aged fifty-two years; referred to me by Dr. A. G. Bennett, of Mahaffey, Pa. The patient stated that she had had more or

[1] I recall that the late George Harley taught that pain invariably accompanied chronic obstruction of the common duct by stone.

[2] But if the gall-bladder contain many calculi, or its duct is early occluded with presence of fluid from simple dropsy or empyema, this rule will not hold.

less "stomach disorder" for ten years, but her general health had been little affected thereby. The symptoms consisted chiefly of slight attacks of what she regarded as epigastric pain, lasting about a half hour and then disappearing. There would be intervals of three or four months between these spells. These slight attacks of presumed "stomach colic" thus occurred for about ten years. They were unassociated with any special gastric symptoms or with noticeable jaundice, until lately. The patient was first seen June 12, 1901. In November preceding she had epigastric soreness, with some little crampy pains in the right hypochondrium. In December there was some colic, lasting about three days, with more or less continuous slight pain, referred to the epigastrium, for two or three weeks. Pain and even soreness then disappeared, and remained absent for a week or two, following which jaundice suddenly appeared when entirely free from pain, and continued for about three weeks. With disappearance of jaundice colicky epigastric pain again recurred, but no cramp was recalled to have been present in the right hypochondrium until she was once more jaundiced, about a month before I saw her. After the first attack of jaundice the skin cleared fairly well, but the scleræ remained icteroid. Since the recent attack she has been quite persistently very deeply jaundiced, but is without pain. The only symptom of that nature is that when lying on the left side discomfort in the epigastrium is experienced. Her weight a year ago was 175 pounds; present weight, 130 pounds. The greater part of the 45 pounds had been lost since the first attack of jaundice. There are no especial dyspeptic symptoms. There are present complete anorexia, extreme mental torpor and physical debility, pruritus, and obstinate constipation. The stools are of pipe-clay hue; the urine is concentrated and of porter color. Although the skin is of a deep saffron hue, she states the jaundice tint had been more marked a week or so before.

Physical Examination. Abdominal walls flaccid; with full inspiration inferior border of the right and left lobe of the liver is readily palpated. Edges sharp, firm, and even; liver somewhat enlarged; gall-bladder not palpable, certainly not enlarged, for the fingers could be depressed below the liver's edge. No sensitiveness to manipulation in the gall-bladder region, and none elsewhere save just below and to the right of the ensiform cartilage, but even here not marked. Spleen not enlarged. First heart sound enfeebled.

Blood. Several examinations (Dr. Ghriskey) average: Leucocytes, 8500; red blood corpuscles, 4,200,000; hæmoglobin, 77 per cent. Several examinations of the stomach contents: Total anacidity; the removed contents always presented the ordinary water-soaked appearance common in cases of achylia; small amount of gastric mucus. No lab reaction with milk incubated twenty-four hours. Gastric motility unimpaired.

Urine. The urine is deep golden-brown; heavily bile-stained, opaque, acid, specific gravity, 1030; well-marked albumin reaction; epithelial, granular, and hyaline casts and red blood corpuscles present.

Diagnosis. Obstructive jaundice, with stone in the common duct; past calculous cholecystitis; nephritis, the result of the chronic cholæmia; probably hepatic cirrhosis in process, due to obstruction. Patient informed of the diagnosis and operation advised. Medical treatment for removal of stone was regarded as futile to attempt.

Patient admitted to my service at the Episcopal Hospital. The attending surgeon then on duty, Dr. T. R. Neilson, saw her with me and concurred in diagnosis. Carcinoma of the gall-bladder and gall ducts was, of course, considered, but was excluded.

To diminish risk of hemorrhage on account of the high grade of jaundice, with the approval of Dr. Neilson I instituted the following preparatory treatment, which was continued for two weeks. It is such as in the case of small, unencysted calculi is sometimes of service in causing their expulsion: Daily morning stomach douching with alternate hot (sodium bicarbonate) and cold (sodium chloride) solution; one-half to one hour before each meal there was administered a combination of sodium sulphate, phosphate, and bicarbonate, in hot water, with the addition of tincture of nux vomica; diet carefully regulated; extract of pancreas as a digestant. Two daily high enemas of normal salt solution—the one hot, the other cold—were given. Under the above treatment the amount of urine, previously so scanty, increased to upward of three quarts daily. Bile appeared in the stools, but the hue of the skin was little if at all changed.

Three days prior to operation I ordered calcium chloride by enema in place of sodium chloride.

Section by Dr. Neilson, June 27th: Liver somewhat enlarged; surface firm; gall-bladder shrunken and empty. A large stone was found densely adherent in the middle portion of the common duct. It was removed with great difficulty. Its size and shape is that of a large-sized olive. It was of enormous size to have so far engaged the duct. The probability is that its accretion occurred *in situ*, where it must have been for a long period. Considering the dense adhesions about it and its bulk, it is impossible to conjecture the manner in which under the preparatory treatment instituted bile should have escaped passed it; but that such was the case was shown by the appearance of the latter in the feces, as stated.

The patient made a good recovery, and subsequently underwent treatment for removal of the conditions engendered by the cholelithiasis. Mention of this treatment is made in the latter part of the paper.

I have here brought together a small group of interesting cases recently encountered which illustrate certain phases of gallstone diseases. These cases represent simple catarrhal cholecystitis, without obstruction; with obstruction; with dropsy of the gall-bladder; with indications of beginning empyema; of pericholecystitis with adhesions the result of past cholecystitis, probably calculous; of chronic obstruction of the common duct by stone, with the usual accompanying jaundice and shrunken gall-bladder.

I shall briefly consider the recognition of such cases as these, the occurrence of which is common. Frank, outspoken cases of cholelithiasis, with severe colic, jaundice, and passage of stone, are so easily recognized that they need neither illustration nor remark. It is the frequent cases without discovered passage of stone and without jaundice that are apt to mislead. The points of greatest importance in the detection of these is to have the fact of their common occurrence in

mind; to recall that however transient the duration of the self-diagnosed "stomach pain," if it is recurring the possibility of its being of gallstone origin is worth considering; to be not satisfied with the statement of the patient that the seat of pain is the epigastrium, but to have him carefully note in the attacks if it has not origin and greater intensity to the right, and if possible to examine the patient during or immediately after a seizure; then careful palpation will usually establish the diagnosis. In the recognition of cholelithiasis, among a variety of simulating conditions it is necessary to exclude simple gastralgia; gastralgia the result of adhesions, as, for instance, from past ulcer; the gastralgia of gastric and of duodenal ulcer; that of adumbilical hernia (in my experience, a not unusual source of presumed simple gastralgia). Ileus and acute pancreatitis must also be borne in mind.

Space is not here at hand for systematic discussion of differential diagnosis. I shall merely refer here to a few distinctive points which I have found of especial value.[1]

The pain of latent duodenal ulcer is apt to confuse; but it, like the pain or gastralgic seizures of gastric ulcer, commonly bears more or less definite relation to the ingestion of food, occurring immediately, or, often with definite regularity, two or three hours after eating. Other usual symptoms, among which is the locality of the pain, assist in its differentiation. Adumbilical hernia, the pain of which, as before remarked, is often mistaken for pure gastralgia and even for gastric ulcer, has its seat of intensity and sensitiveness at the site of the gripped point of omentum, the small nodule of which is commonly easily felt with careful palpation in the median line above the umbilicus. Perigastric adhesions often cause obstinate gastralgia, but they are not apt to simulate the pain of calculus except when the pylorus or duodenum is adherent to the gall-bladder, and then there is or has been usually a calculous cholecystitis. Similar gall-bladder adhesions to the duodenum, omentum, or colon causing intermittent obstruction of the bowels, with alternate diarrhœa and constipation, of which I have seen several instances, are often puzzling to diagnose. Careful interrogation as to past history of liver colic and the presence of a sensitive gall-bladder region assist materially in their recognition.

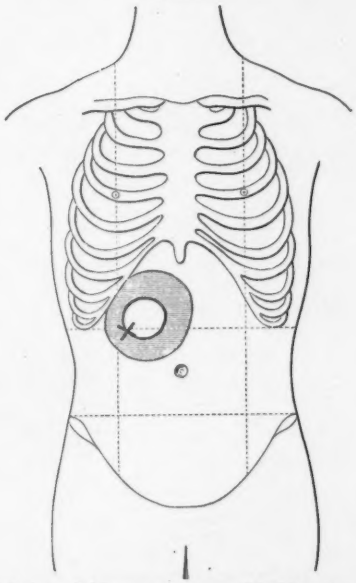
Spasm of the pylorus occurring with gastrosuccorrhœa and the pains of periodic gastrosuccorrhœa, occurring as these pains are most apt to, through the night, has misled. An interesting case of this sort I recently reported to the American Gastro-enterological Association, but it is not yet published. It is worthy of brief outline here. The

[1] I have not discussed the use of the X-ray in the diagnosis of cholelithiasis, since in the class of cases in which its assistance would be of real value—stone in the cystic duct or in the common bile duct—it cannot at present be employed to obtain results.

patient was under treatment with several practitioners for supposed gallstones for a year and a half before being sent to me by the late Dr. Charles Wirgman.

T. B., aged thirty years; store porter, of spare build; weight about 120 pounds; no typhoid; no syphilis. He had been the subject of attacks of sharp, cramp-like pain in the abdomen for several years. The first attack occurred three years before; then there was a lapse of one and one-half years; the seizures were very frequent in the past year and a half. Pains suddenly develop, without previous warning, in the epigastrium and to the right, in the pyloric region, shooting thence

FIG. 2.



Inner circle area of fulness and firmness very perceptible when stomach inflated with air; then this area too tympanitic. The cross indicates the starting point of cramp, during the occurrence of which a prominence approximately as denoted by the shaded area appears. Pains radiate thence over the abdomen and through the right hypochondrium to the back.

toward the epigastrium, umbilicus, and into the back; pains may last one or two days, but commonly their duration is but a few hours. Never jaundiced. Attacks occur, as a rule, between 1 and 3 A.M. Nausea is apt to accompany colic, but never vomiting unless self-induced; the vomit is then copious in amount (he states one to three quarts of acid fluid). Pain relieved by free emesis. Eats a cold lunch at noon and a hot supper, when very fatigued, at 6 P.M., retiring at 10 P.M. Twenty pounds loss in three years. He believes his previous occupation, that of a car driver, necessitating exposure and hasty, irregular eating, responsible for his ailment.

Physical Examination. Mitral presystolic murmur; heart unenlarged; much dilated stomach; no tumor or sensitiveness save in pyloric (or gall-bladder) region, and then only during presence of pain. Gastric capacity, 3400 c.c. (after having been accustomed to the use of the tube); pronounced stagnation of food; sharp hyperchlorhydria. Inflation showed fulness and firmness in pyloric region —on inflation, prominence the size of a hen's egg, tympanitic on percussion and not very sensitive—a cramped pylorus. Patient seen in several seizures. Situation of pain rather suggestive of gallstone colic. Fulness and firmness in region of pylorus, a little below and to the left of normal situation of the gall-bladder. (Fig. 2.) Here there appears the above-mentioned palpable prominence, behavior of which to manipulation is unlike that of the gall-bladder. Tube introduced during seizure invariably removed a large quantity of fluid, 1 to 2 litres, which presents the appearance of gastric secretion; very little food particles evident if some hours after a meal; high percentage of HCl present; immediate lavage with sodium bicarbonate solution instantly terminates attacks. This was the case in the first seizure in which I saw him, and has been invariable since. The employment of the tube taught the patient, and thus he always was able to abort an attack.

Attacks ceased in a few months on local treatment with silver, alumnol, and bismuth, and daily lavage. The patient was under constant observation for three years, and then seen at intervals to the present. The local treatment was continued for several months and then an interlapse, to be re-begun with recurrence of seizures. At the end of about a year they ceased finally, and none have now been present for several years. At first the advisability of an operation on the pylorus or a gastro-enterostomy was considered and arranged for, but the patient would not finally consent, as his impoverished condition would not permit him to neglect his work, a family being dependent upon him for support.

This case is evidently one of past latent ulcer, followed by cicatricial contraction of the pylorus, with subsequent dilatation of the stomach. The attacks were those of gastrosuccorrhœa, with sharp pyloric spasm. The correct diagnosis was only possible by the employment of the stomach tube. As remarked, two practitioners of note prior to his consulting Dr. Wirgman had had the case under observation for one and a half years, regarding it as one of gallstone disease. No gastric examination had been made, and he had never been seen during an attack. Gallstones had been unavailingly searched for. Cases of this sort are not common, but are readily enough recognized if one is on the alert and employs modern methods of examination.

Simple gastralgia, the result of pure hyperchlorhydria, is a common enough affection, and may for a time be quite difficult to separate from mild catarrhal calculous cholecystitis. The pain, however, bears a more definite relation to food than does gallstone colic, occurring pretty definitely two to three hours after meals, but may, as in gallstone colic and in periodic gastrosuccorrhœa (which has gastralgia as an accom-

paniment), be most usual at night, although no hypersecretion accompanies the gastralgia. Commonly treatment instituted for the hyperchlorhydria promptly establishes the diagnosis. An illustrative case is the following:

J. M. S., aged sixty-two years; was first seen June 2, 1902. Referred by Dr. Walter Freeman. For the past one and a half years, following an attack of supposed grip, gastralgic pain, occurring at intervals of from four to five months up to last March. Since March occurring every day or so; past few weeks rarely misses a day; occurs especially when he applies himself at desk work. Six to eight years ago he had similar attacks for a short time. These disappeared entirely when he lived more in the open air. Occupation now very sedentary; takes no exercise. Appetite good when free from pain; constipation. Pain appears in the centre of the epigastrium and passes through both hypochondria to back; lasts one to three hours; diminishes in severity when he lies down; hot applications relieve. No "heartburn," occasionally water-brash; pain not especially influenced by food, but eating may relieve. No typhoid fever; no lues.

Physical Examination. Nothing noteworthy; heart normal; no sensitiveness in gall-bladder region in several examinations, or in other portions of the abdomen; stomach normally placed and undilated. Knee-jerk, station, and pupils normal.

Several examinations of the stomach contents: Hyperchlorhydria; marked atony. Urine: Trace of albumin; glucose absent; a few hyaline and granular casts; free uric acid; numerous red blood corpuscles, probably originated through irritation by the uric acid precipitated in the tubules.

Cessation of attacks was very prompt in this case under regulated diet; Carlsbad salts on rising; a full dose of an antacid three hours after meals and a combination of nux vomica, cannabis indica, and codeine before meals—codeine was taken for a short time only. At the end of a month nothing save a sodium sulphate laxative in the morning and an antacid three hours after meals were prescribed. No pain has occurred to the present (March) from two weeks after he was first seen, now nine months ago.

A similar but much more obstinate case of presumed pure gastralgia now under treatment is also of diagnostic interest. I had first suspected there might be latent cholecystitis, and examined him many times resultlessly for presence of sensitiveness in the gall-bladder region.

C. J. B., aged sixty-one years; first seen September 9, 1902. In good health up to two and one-half years ago, when epigastric pain developed. Pain occurs two to four hours after meals, and is most common at night, then there may be a much longer lapse. He fancied eating did not allay the pain, but after he had been under treatment assured me that eating is invariably remedial, pain occurring soon ceasing after a glass of milk and a few crackers. Pain in centre of the epigastrium. Seat of greatest intensity immediately below the ensiform; thence radiates, when severe, through to the back. Later, he stated, the seizures have been very severe, pain sharp and paroxysmal, but at times merely a dull ache. Duration an hour or two. No nausea

or vomiting; appetite good, but fears to eat. For some months has been on starvation diet, and is debilitated in consequence. Constipation, but regularity maintained by laxatives. Best weight, 215 pounds; now, 190 pounds. Moderate drinker in the past, now for years a total abstainer; moderate tobacco user; no syphilis. Some years ago malarial fever; no other ailments; father died of liver disease; mother, aged fifty-five years, of cancer of the stomach. He feared the latter ailment, and was much depressed mentally.

Physical Examination. Knee-jerks, station, and pupils normal; stomach normally placed; no point of sensitiveness anywhere about the abdomen; gall-bladder region in many examinations totally free from sensitiveness; heart normal. Several examinations of the stomach contents: Sharp hyperchlorhydria; motility normal; three hours after a meal of steak, bread, and water, total acidity 124. HCl equal 0.365 per cent. Urine: Fair trace of albumin; hyaline casts. The patient was seen in one attack. Hypersecretion and hyperchlorhydria were found to exist. Lavage with warm sodium bicarbonate solution quickly dissipated the pain. Examination during and subsequent to the attack revealed no gall-bladder sensitiveness.

Treatment. A morning laxative of equal parts of sodium sulphate and phosphate. Before meals, cannabis indica, codeine phosphate, hyoscine hydrobromate; a full dose of antacid three hours after meals. Ordered to eat between meals when possible, then no antacid. After a week's treatment pain occurred rarely by day, but was more usual three or four hours after the evening meal, and from 1 to 2 A.M. It had lost its intensity markedly—now a dull ache, when formerly it was often an unbearably severe colic. For the first two or three days pain not markedly influenced by antacids, but subsequently and now invariably checked within a few minutes by a teaspoonful of a powder containing equal parts of sodium bicarbonate, magnesium carbonate, and oleosaccharate of peppermint. Codeine discontinued at the end of a week, and strontium bromide, cannabis indica, and hyoscine substituted for the above combination. This was again replaced in ten days by silver nitrate and hyoscyamus. Pain having entirely ceased under this and the antacid, which he now took regularly three hours after meals, all medicine save the antacid was discontinued. No pain occurred for two weeks, when a night indulgence in ice-cream, cakes, and lemonade provoked a transient recurrence. He now takes the antacid regularly, and the stomach is douched with silver nitrate solution twice a week. Dull pain now occurs rarely at night, quickly dissipated by the antacid. I regard this case as one of pure gastralgia. There are no indications of adhesions. The possibility of latent gastric ulcer is considered. Gallstone colic is positively excluded.[1]

Although acute pancreatitis, with or without disseminated fat necrosis, is an affection of comparative infrequency, its association with gallstone disease, in consequence of the latter, is well known. Acute and chronic pancreatitis may be originated through the presence

[1] Since the above writing (three months) the patient has been free from attacks. The later treatment, which has been most beneficial, is courses of alumnol and silver used through the stomach tube.

of a calculus in that portion of the common bile duct near its duodenal orifice, at which point pressure may be also exerted on the contiguous pancreatic duct, interfering with the flow of pancreatic secretion into the bowel or admitting of the retrojection of bile into the pancreatic duct, as suggested by Halsted and Opie. If, as is the case in about one-third of human subjects, there is either merely the single pancreatic duct of Wirsung, or no communication between the latter the subject of occlusion, and that of the accessory pancreatic duct (of Santorini) which opens into the duodenum separably from the duct of Wirsung, conditions favorable for widespread fat necrosis and pancreatic disease exist. The pancreatitis in such cases is the result of long-continued obstruction plus infection. The obstruction offers conditions favorable for the growth of micro-organisms which have passed from the duodenum into the pancreatic duct and thus into the vulnerable organ. Without such infection it is probable that, by obstruction alone, a chronic interstitial pancreatitis may originate by virtue of the irritation resulting from the long-continued damming up of the pancreatic secretion.[1]

Without cholelithiasis, and without such obstruction of the pancreatic duct, it is likely that infection of the pancreas from the duodenum, causing acute or chronic inflammation, may occasionally occur. Such a condition may be especially looked for in cases of chronic gastritis of bacterial origin. In several cases of chronic gastritis which I have had under observation in which inflammatory changes in the secretory glands exist, presumably the result of infection, there were indications of chronic interstitial pancreatitis which I regarded as due to a similar transmitted infectious process.

The following most instructive case is in all probability one in which acute pancreatitis was so produced. It is of extreme interest, since the diagnosis by the attendants, who had been misled by the previous history, was at first that of collapse from perforation the result of a gallstone, and finally that of impaction by a biliary calculus without perforation. This case forcibly illustrates the difficulty sometimes encountered in differentiating between acute pancreatitis and gallstone disease. Briefly the points are: There had been two attacks of acute gastritis, in which I saw him; following which gastralgia appeared. There was a chronic subacid gastritis (with erosions), probably from mouth infection. About two years after the second attack of acute gastritis, while in another city, there suddenly developed overwhelmingly severe pain in the abdomen, followed by collapse. The diagnosis of his numerous attendants was as stated above. Section demonstrated

[1] See a paper by Opie, The Relation of Cholelithiasis to Disease of the Pancreas and to Fat Necrosis, THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES, January, 1901.

entire absence of cholelithiasis or any of its consequences, and the presence of some old adhesions and of recent lesions such as are indicative of acute pancreatitis. The case is as follows:

C. M. L., aged forty-seven years; plethoric habit; weight, 210 pounds; sedentary occupation; very little exercise or fresh air; indiscreet in diet; moderate alcoholic indulgence; tobacco in excess; no lues. Attack of acute gastritis in the early part of 1897, in which I attended him in consultation with the late Dr. J. M. Da Costa. A similar attack a year later, in which I also saw him. On each occasion the symptoms were those of a general infection, with a local expression in the stomach. Vomiting had occurred at the early part of the attack; stomach-contents foul smelling; free HCl and the ferments absent; excess of organic acid; fever; epigastric sensitiveness and pain; congestion of the base of the right lung in each seizure. Urine contained albumin, hyaline and a few granular and epithelial casts. Following the first seizure of this sort there were recurring spells of mild gastralgia, in duration an hour or two and occasionally longer. Pain rarely severe, and commonly easily checked by lavage and the use of codeine. Repeated physical examinations gave no indication of the pain being other than gastralgic. Several examinations of the stomach-contents in the interval during two years always showed: Invariably absence of free HCl; pepsin and lab ferments absent; the pre-enzymes in traces only; acidity low (10 to 20). Blood-stained bits of the mucosa occasionally found in the wash water, presenting the usual appearance of erosions. Gastric motility normal save during the acute seizures. Stomach undilated and normally placed. The urine in the interval of attacks of acute gastritis was practically normal. There existed a severe type of pyorrhœa alveolaris. This had been present for years, and had never received adequate attention. Bacterial cultures from the gingival margins showed among many other organisms the staphylococcus pyogenes albus and aureus.

Diagnosis. Attacks of acute gastritis intercurrent with chronic glandular gastritis; gastric erosions; gastralgia; the gastritis probably the result of the alveolar pyorrhœa. The gastralgia was regarded as probably of nervous origin, although the possibility of its arising from perigastric adhesions the result of long-continued gastritis was noted. Gastralgic pain tended to recur despite medical treatment, and after the second attack of acute gastritis the patient was persuaded to stop work and take a six weeks' summer holiday. Gastralgic pain had then been annoying him considerably. This immediately and entirely ceased from the day he abandoned business. He went into camp in Canada; tramped, fished, and shot, eating ordinary camp food and frequently getting wet. This exposure, with rough food and a great deal of active exercise, in the nature of things should have been productive of attacks of gastralgia had they been due to adhesions. Their non-recurrence and their complete absence for some months after his return, despite active tennis, suggested these pains were of nervous origin. The following winter (1898–99), despite close application to business and general unhygienic living, he was in better health than he had been for a long time. The succeeding summer his outing was brief and his application to work close. In the autumn following (1899) I saw him in two attacks of presumed gastralgia; in one he was confined to bed for

twelve hours, and the pain was quickly relieved by lavage. There had been diffuse gastric colic, associated with stagnation of food and decomposition of the ingesta. The cardia was in spasm, so that the stomach tube was entered and withdrawn with difficulty. The second attack immediately followed a dinner party. The pain had been of a half-hour's duration when I saw him in my office, and was instantly checked by lavage.

Some months later, while in another city, he had an attack altogether unlike any of the preceding. There suddenly appeared severe abdominal pain and vomiting. On the arrival of his physician he was in a state of collapse. There was stated by his attendant to be "cyanosis, shallow thoracic breathing, diffuse abdominal pain and tenderness" (the pain and tenderness thought by the attendant to be largely epigastric and hepatic), "a rapid, thready pulse and cold sweat." Calculous cholecystitis, with rupture of the gall-bladder, perforating duodenal or gastric ulcer, it was reported were thought of, but the condition was so alarming that little examination was immediately possible to determine the exact diagnosis. It was with difficulty that he was rescued from the collapse which had so suddenly occurred. For three days following it was reported that he was so ill that he was unconscious of his surroundings. There were fever (101° to 102½° F.) and incessant hiccough for about a week. There were "congestion of the base of one of the lungs" and "albuminuria and a slight biliuria." In addition to his regular attendants he had been seen by several medical consultants of eminence and a surgeon of equal note, and it was unanimously agreed that the case was undoubtedly gallstone, with possible perforation, and if not this, at least impaction of a large stone in the duct. Operation was regarded as essential, but his condition did not warrant it being undertaken until about three weeks after the onset of the seizure. The diagnosis of either perforation by a gallstone or of impacted calculus was arrived at by the attendants through a process of exclusion, and because the previous history had made it certain to their minds that the various gastralgic attacks and those of acute gastritis which had occurred in the past were undoubtedly only expressions of the vagaries of cholelithiasis. Upon this there was apparently no dissension, although in correspondence with the attending physician I urged that there had been nothing in the nature of the previous seizures to suggest this; that gallstone colic had then been carefully excluded.

Section disclosed the following: Patient's abdomen very thick walled; adipose tissue at least three and one-half inches; gall-bladder and bile ducts normal; no present or past indications of gallstones. Instead there existed evidences of recent peritonitis; a mass of adhesions binding the hepatic colon, stomach, and pancreas, some recent and some old. Omentum thickened. Pancreas adherent to stomach; *inflammatory mass about and involving an enlarged pancreas.* The operation had to be conducted with great celerity because of the patient's condition, and, it was stated, little time was permitted for examination after separation of adhesions. It was, however, noted that the pancreas was much enlarged, and this enlargement at the time was thought to be the result of a malignant growth. The subsequent history of the case has disproved this. The patient is now living and in good health. As I remarked, I have no doubt that the attack was

one of acute hemorrhagic pancreatitis—an acute pancreatitis of infectious origin perhaps engrafted upon a chronic inflammatory condition of this organ. The infection originating the pancreatitis probably bore some relation to the long-existing chronic glandular gastritis, which itself was presumably due to the continued passing of pus organisms from the mouth into the vulnerable stomach.

The origin of the old adhesions about the stomach is in doubt. The two attacks of gastritis spoken of were unaccompanied by indications of perigastritis—at least the local inflammatory conditions were not then regarded as sufficiently severe to suggest this. Subsequent to operation the patient recalled that years before he had had a fall, striking the abdomen, and it was thought possible that adhesions might have so arisen. That these old adhesions about the stomach bore some relation to the earlier attacks of gastralgia I have no doubt, but that they were the sole cause of this I question, for the reasons cited.

This case well illustrates the difficulty that may attend the separation of an attack of acute pancreatitis from presumed perforation by a gallstone, and indicates how a previous history of epigastric pain may mislead even the most skilled diagnostician. But for such a history, which at once led to the diagnosis of gallstone disease by his attendants, in consequence of which the question of pancreatitis was not, I believe, even considered, it might have received attention. The sudden onset, when in presumed good health; severe abdominal pain; vomiting of at first the contents of the stomach and, later, copiously of bile; the rapid appearance of collapse, continuing, with the occurrence of obstinate hiccough and the like, as detailed, were very suggestive.

The Treatment of Cholelithiasis. There is no solvent for gallstones in the gall-bladder or in the bile passages. The employment of sodium cholate, of sodium succinate, and sodium oleate; of the more rational sodium salts presumed to have some cholagogue effect, such as the phosphate and sulphate; of the old French mixture of ether and turpentine, and of chloroform, is no longer favored by the intelligent physician with the expectation of dissolving calculi in gall-bladder or bile ducts. I confess that some fifteen years or more ago I was an adherent to the contrary notion, and, as a disciple of George Harley, for several years religiously saturated my gallstone cases with sodium cholate and the like, with vain expectation of promoting solution and expulsion of calculi. After a few years of increasing familiarity with the pathology of cholelithiasis, aided by the teaching of the operating and post-mortem table, I became convinced of the futility of the solvent treatment. Treatment of active cholelithiasis is now justly very largely abandoned to the surgeon. There is no medical treatment for persisting dropsy of the gall-bladder, or for obstruction of the cystic duct; for seropurulent or purulent inflammation of the gall-bladder, or for stone long lodged in the common bile duct. But it is unnecessary, and the surgeon is usually unwilling to accept that we shift to him the cases

of simple calculous cholecystitis, presumably without obstruction—cases such as those first cited—until after a fair effort to dissipate the ailment without the knife. If the patient is in a position to have the best done for him at home, and, if necessary, to visit Carlsbad for a season or more, even though the attacks at first show a tendency to fairly persistently return, should they remain mild in character and should enlargement of the gall-bladder not be evident on repeated examination, nor persistent sensitiveness be present, it is proper that such cases be not hurried to the surgeon. Medical treatment, however, is not to be instituted with the view to the solution or extrusion of calculi, but with the object of both controlling the inflammatory catarrhal process in the gall-bladder and of preventing its recurrence, trusting with its abatement that the calculi present will no longer create trouble. It seems probable, as before remarked, that gallstones do not mechanically develop cholecystitis, whereby their presence is manifest. Our present knowledge of the pathology of that affection is against this old notion. It is also likely that only very rarely does attempted expulsion of a stone from the gall-bladder occur without a coincident cholecystitis, the latter, as Kehr remarks, being actually the force that initiates the movement of the stone. Cholecystitis is a very frequent condition, and is far more frequently latent than active, for with presumably almost 10 per cent. of adults carrying these concretions, but possibly somewhat more than 5 per cent. of this very large number have recognizable indications of their presence.

Briefly, I should place the necessity for surgical interference in these cases of catarrhal cholangitis, without presumed obstruction of the duct, in this wise: If the patient is well-to-do, and can spend a season or two at Carlsbad; if there is no strong family history of cancer;[1] if the cholecystitis is recent and of mild type and shows a tendency to no persistent recurrence after some months of treatment, surgical intervention, although not improper, may be regarded as yet unnecessary. Should there be an old history of recurring pains, and the attack for which one is consulted suggests cholecystitis, I regard the case as immediately surgical, for in such a one further recurrences are probable, and the likelihood of pericystic adhesions is strong. Concerning the question of necessity for surgical intervention in cases of stone in the common duct, my view is that these should be operated on no later than a month after a jaundice has developed; since with prolonged obstruction, and with so few if any adequate means at hand to promote passage of the stone, and with danger of complication so vital, it is

[1] The development of carcinoma of the gall-bladder is favored by the presence of gallstones; about 14 per cent. of gallstone subjects develop cancer of the gall-bladder (Kehr). Courvoisier found gallstones present in 87 per cent. of cases of carcinoma of the gall-bladder, and Ames in 95.4 per cent. (quoted by Kehr).

unmedical and unscientific to delay. A stone sufficiently large to completely obstruct the duct, after a month's impaction, in the vast number of cases, is lodged permanently unless removed. No amount of oil or Carlsbad treatment here after this lapse is likely to be efficient. Although jaundice may be temporarily diminished, the stay of the stone will be uninfluenced, while, in consequence of the persistent back-pressure, pathological alterations in the liver structure are soon in progress. Hepatic cirrhosis is a not uncommon result of long-continued biliary obstruction, as are, under the influence of the cholæmia, changes in the kidney. In the case of Miss D. B. related, although the stone had probably not been carried many months, the liver already displayed indications of cirrhosis, and a pronounced nephritis was present, of presumed cholæmic source. This case well illustrated the utter futility of medical treatment in a subject with stone of large size fairly long lodged—the inutility of any drug, however active, as a stone solvent or as an aid to stone expulsion. In this case accretion of the stone probably had occurred in the common bile duct, since it may be regarded as too massive to have passed the cystic duct without more marked symptoms than were originally present.

Other and not remote dangers of prolonged obstruction of the duct to be mentioned are perforation of the duct and pancreatic disease—pancreatic fat necrosis, and acute or chronic pancreatitis. Pancreatitis may follow very shortly after the lodgement of a stone in a situation to obstruct the duct of Wirsung. Cases are reported in which, as stated by Opie,[1] decided pancreatic lesions have followed forty-eight hours after the onset of symptoms of impaction of the calculus, a period too short even for the production of marked jaundice. Although such cases are unusual, the later occurrence of pancreatitis in consequence of obstruction is less so, and is, with other risks, one which physicians must consider, not too long delaying surgical co-operation.

The one object in the treatment of simple cholecystitis is to endeavor to render quiescent the inflammatory process in the gall-bladder and prevent, rather than favor, the passage of a calculus from that viscus. During and following the acute seizure active purgation must be avoided, as must the use of all measures which are presumed to have cholagogue effect. Under no circumstances, even in the quiescent period, must massage of the gall-bladder or of the gall-bladder region be attempted with the idea of diminishing the size of this organ or of assisting to expel its contents. Should a gall-bladder be palpable after an attack, its duct is in all probability obstructed, and the only treatment is surgical. The risk of rupture of an inflamed gall-bladder through massage is not slight. Morphine must be employed with cau-

[1] The American Journal of the Medical Sciences, January, 1901.

tion in acute cholecystitis because of the danger of masking the local inflammatory condition, and because of the effect the drug may have upon the stomach, acting, as it so frequently does, to later enhance the already existing gastric irritability. Nausea and vomiting and pain, save when a stone is presumably already in passage, should be controlled by other means. *Persistent* nausea and vomiting in simple acute cholecystitis probably indicate that the calculus has already entered the cystic or common bile duct, and even if such is not the case, vomiting reflexly favors the engagement of a calculus.

In the treatment of a case of cholecystitis in the interval it is important to ascertain the condition of the motor and secretory gastric functions, and to appropriately treat any existing abnormality. Chronic gastritis frequently accompanies cholelithiasis, and when the former is of mycotic origin it favors the occurrence of the latter. The hygiene of the mouth should likewise receive attention, that infection of the stomach from diseased teeth or gums be obviated. It is held that gallstone suspects, irrespective of the condition of the motor or secretory gastric functions, should take food at short intervals, with the idea that stasis of bile in the gall-bladder and resulting colics be thus rendered less likely. Clemm, of Darmstadt,[1] for instance, while stating that all catarrhal gastro-intestinal affections should be thoroughly treated, suggests that "there should not be more than two or two-and-one-half-hour intervals between meals, with milk between at least twice," and that "a glass or two of milk should be taken before rising in case of the slightest suspicion of stoppage of the flow of bile," and that "the earliest and last meal should be principally albumin and fats;" and Kehr, who is also an advocate of frequent feeding, urges that a meal be taken on retiring. While it is true that during fasting the gall-bladder acts as a reservoir for bile, and that frequent feeding favors its direct flow into the bowel, the risk of increase in gastric atony, should this exist, and of aggravation of the gastro-intestinal catarrh so often present, with transmission of this catarrhal process from the duodenum to the bile duct, is sufficiently great to necessitate caution in the matter of very frequent meals. Feeding in this way is only indicated in those with well-preserved gastric motility or with hypermotility, and especially in such cases with hyperchlorhydria. The interval of meals should thus depend altogether upon the ability of the stomach to empty itself and largely upon the condition of the secretory function. In cholecystitis, as there is no interference with the passage of bile and pancreatic juice into the intestine, and as the gastric secretory power may be normal, no very special diet is essential.

[1] Wiener med. Presse. Quoted in the Journal of the American Medical Association, September 6, 1902.

The food must, of course, be plain and easy of digestion; high seasoning must be avoided and rich entrées and pastry tabooed. No digestant is indicated if the gastric secretory power is normal and proper insalivation of food is enjoined. In obstruction of the common duct, in which there may be coincident obstruction of the pancreatic duct, as with the stone in the diverticulum of Vater, the diet should be largely albuminous, and food into which the composition of starch enters little if at all allowed. If substances containing starch are eaten, the starch should be either first dextrinized or diastase should be administered. Pancreatic extract can be of little real value as a digestant if the gastric secretory function is normal or heightened, as destruction of its ferments in the stomach is certain; but with subacidity or anacidity, fairly frequently present in these cases, pancreatic extract may be freely given with meals to serve the triple purpose of an albumin, starch, and fat digestant. It is then probably of more value, by virtue of its contained steapsin, than is the conjoint use of papain and diastase alone, which later are practically without action on fats.

Gastric atony accompanying cholelithiasis is best treated by daily morning stomach douching with alternate hot and cold water; weak sodium bicarbonate or Carlsbad salt solution in the hot water and sodium chloride in the cold—the last is preferably a weak quassia or calumba infusion. In all cases there is prescribed sodium sulphate either alone or in one of the Carlsbad combinations, such as the Carlsbad salt in powder or in crystal form,[1] or Carlsbad water, or, what I prefer and have used for years, a combination of sodium sulphate and phosphate or of sodium sulphate, phosphate, and bicarbonate. The salt is administered in rather hot solution on rising, subsequent to the lavage if this is practised; a small quantity of bitter infusion, such as quassia or calumba or of the tincture of nux vomica, taken coincidently, renders the saline draught better borne by the stomach and stimulates its passage into the bowel. Movement and breathing exercises should be taken after its ingestion, and no food is permitted for upward of an hour afterward. The solution should be drunk slowly and either in sips or in small draughts, at a few moments' interval, as its passage from the stomach is thus more rapid than if it has been hastily gulped. If the bowels are sluggish, and a tendency to looseness is not set up by the Glauber salt, I give a similar combination in smaller dose a half-hour before lunch and dinner, and on going to bed if food is not then taken. When sodium sulphate or phosphate is used more often than once daily and long continued, the dose should not ordinarily exceed gr. xx to ʒss of each. If hyperchlorhydria exists, sodium bicarbonate

[1] The crystalline salt is more laxative, containing a much larger percentage of sodium sulphate than the salt in powder form.

is omitted from the early morning combination, and a full dose (gr. xl to gr. lx) given either alone or in combination with a small quantity of Glauber salt or sodium phosphate three to four hours after the preceding meal and not later than one-half hour before the following one. The fluid extract of taraxacum or the succus taraxacum in 1-drachm to 2-drachm doses is coincidently administered.

Whatever the condition of the motor or secretory function of the stomach, notably good results are often obtained in cases of cholelithiasis by the daily morning use of strong sodium bicarbonate solution through the stomach tube, in the following manner: A funnelful (about 750 c.c.) of water at 105° to 110° F., containing two heaping teaspoonfuls of sodium bicarbonate, is passed into the fasting stomach, the intragastric extremity of the tube engaging the cardia (approximately sixteen inches); the funnel is held some distance above the head to obtain a douche effect. The stomach region from the fundus to the pylorus is massaged as the fluid enters, and subsequently for two to three minutes, after which the solution is siphoned off, and the stomach is douched once or twice with cool normal salt solution. The effect of soda thus used is beneficial in promoting a free outflow of bile into the bowel and in diminishing the viscidity of the bile. Should the bowels be acted upon too energetically, the stay of the soda solution in the stomach is lessened or the quantity of soda used diminished, and no saline laxative follows its employment.

Abundant out-of-door exercise, tennis, horseback-riding, and the like, except in case of very recent active symptoms, is insisted upon. Too energetic exercise is not permitted when there is persistent sensitiveness in the gall-bladder region or when there is a history of frequent recent attacks of colic. Energetic breathing exercises, general light massage, walking, hill-climbing, are all of utility in latent cases in stimulating the hepatic function and in obviating bile stasis.

If the trouble recurs despite carefully carried out treatment on these lines, and the patient is well-to-do and disinclined for operation—necessity for which not seeming too imminent—I advise a sojourn at Carlsbad. There, where business and family cares and social duties can be laid entirely aside and the life of the place becomes a pleasant incentive to recover health, much more may be accomplished on a similar regimen than at home. A woman patient with chronic cholecystitis whom I sent to Carlsbad three years ago, and who was rid of recurring attacks by two seasons there, received approximately the following course of treatment: Before rising in the morning it was customary to sip a tumbler of hot Sprudel water. Immediately after rising gentle exercise was taken, such as walking about and dressing, and in fifteen minutes a second tumbler was slowly drunk, followed by a third a half hour later. If the patient's strength permitted there was a considerable

interval (upward of an hour) before breakfast, during which a rather active walk was indulged in. Breakfast was commonly very light, such as toasted bread and tea, the latter without milk and sugar. This was followed in two hours by a more substantial repast—minced chicken on toast. Two hours later minced ham or chicken, with a purée of pea, potato, or spinach, was eaten. Three hours subsequently two tumblersful of cold Sprudel water were taken, with a lapse of a half-hour between, and in three-quarters of an hour after the second a meal similar to the last mentioned was indulged in. A tumblerful of Sprudel water was finally drunk before retiring. There were in addition the inevitable peat poultices applied to the hypochondrium. A good deal of out-of-door exercise was insisted upon. A number of small gallstones were voided while at Carlsbad. Quite a similar line of treatment, substituting the Priessnitz compress for the peat poultices, had been previously attempted here, but without much result, largely owing to the lack of earnest and persistent co-operation of the patient.

The object of treatment in these cases of calculous cholecystitis is not to promote expulsion of stones, but to dissipate the underlying catarrhal process and prevent its return, and, by maintaining persistent fluidity of the bile, to obviate further stone formation. Under the Carlsbad treatment and its modifications, however, small stones often are voided, leading the patient to imagine that he is thus rid of his trouble. If these calculi have not already engaged the cystic or common duct their passage from the gall-bladder is rather an unfortunate than a favorable circumstance, since the extrusion into the duct of a calculus too large to be readily if at all passed may be similarly favored.

The treatment of recent cases of stone in the common duct belongs to the physician, but for a short time only. Frequently the stone is passed into the bowel, entirely without treatment, a few days after the onset of colic. In other cases the calculus may linger in the duct despite all that is done to effect its dislodgement. In these cases of obstruction of the common duct, after the acute symptoms of obstruction have passed, I am in the habit of employing the sodium laxatives above mentioned and of resorting to the intragastric douche, with warm sodium bicarbonate solution and of high enemas of hot and cold normal salt solution, as before detailed, both for the purpose of reflexly favoring the onward passage of the stone into the bowel and of allaying the accompanying catarrh of the bile passages.

Formerly I was much inclined to the employment of olive oil in obstructions of the common bile duct by stone, and for several years used it rather freely, with results which apparently justified my confidence in this remedy. In recent years I have employed it but little, largely because of the constantly met with repugnance of patients to the remedy and because of the difficulty in its retention by the stomach

when administered in the full doses necessary—and also, perhaps, because I became skeptical of its utility, cases not infrequently occurring in which passage of the stone, because of its size, could not be thus influenced. In recently reviewing my notes of several cases of common duct obstruction in which I employed oil some years ago, and in which there followed cessation of colic and passage of calculi of fair calibre (in one case a triangular-shaped calculus the size of a beechnut was voided), I questioned if it was wise to entirely abandon this remedy. Naturally oil can be of no utility in case of massive calculus, but, considering the paucity of our remedies, it is worthy of at least brief trial in recent cases of obstruction of the common bile duct, for if it can be of no utility, its employment is unattended with harm. In searching for an explanation for the mode of action of the oil, presuming the result sometimes obtained is not entirely a *post hoc* one, it occurred to me some years ago its utility might rest on a sound therapeutic basis,[1] and that there seemed reason to suppose the effect attributed to the oil might be due rather to a product of its decomposition, glycerin. With unobstructed pancreatic flow it is not improbable that by virtue of the fat-splitting ferment steapsin a portion of the oil is disassociated in the duodenum into its components, fatty acids and glyceryl, and that nascent glycerin thus formed exerts in the duodenum an effect somewhat analogous to that which takes place when glycerin is introduced into the rectum—withdrawing water and causing hyperæmia, and causing irritation of the afferent nerves of the part with which it comes into contact, and thus leading to active reflex peristalsis. I believed that a similar effect might result from the presence of nascent glycerin in the duodenum as occurs from the introduction of glycerin into the rectum for its cathartic action. In my paper on this subject I remarked, in effect, that in addition to the active contraction which might be caused by the presence of glycerin in the duodenum, and which of itself would probably tend to contraction of the bile ducts and perhaps of the gall-bladder, the power of diffusion possessed by glycerin would perhaps enable it to enter the ductus communis, and even the hepatic ducts and the cystic duct, producing a similar depletion of the vessels there, and reflexly exciting the muscular fibres of these ducts to contraction. In consequence of this action an outflow of diluted bile would be favored which I thought would assist in expelling the stone. I said that since no other explanation is at hand as to the efficiency of the oil in these cases, and that, as is well known, glycerin is normally so formed from it in the bowel by aid of the fat-splitting ferment of the pancreas, and since it is probable that glycerin can produce the

[1] See my paper, A Suggestion as to the Action of Olive or Cottonseed Oil in Gallstone Colic: Observations on the Use of the Oils, and Report of Cases. The Medical News, November 23, 1889.

effects attributed to the oil, it may be not unlikely that these are due to glycerin thus formed. Rosenberg about this time reported he had found by experiments on dogs with gall-bladder fistula that large doses of olive oil greatly increased the quantity and diminished the consistency of the bile excreted.

After the publication of my paper suggesting this theory of the action of the oil, glycerin was suggested in the treatment of cholelithiasis. If the utility of glycerin is in the manner I proposed, unless it could be immediately brought into contact with the duodenum without a stay in the stomach it would be useless as a remedy. Some trials which I later made with it in impacted gallstone were resultless.

Olive oil employed in the manner outlined in my paper is certainly worthy of a trial in recent cases of common bile-duct obstruction by stone.

Preparatory Treatment before Operation in Cases of Obstruction of the Common Duct by Stone. Although this subject belongs rather to the surgeon, a few remarks concerning it here are apt, because of its extreme importance. It is well known that with cholæmia resulting from persistent obstruction of the common duct, and especially in cases in which there is coincident disease of the pancreas, there often exists a malignant hemorrhagic tendency which, unless strenuous efforts are made to overcome it, may readily terminate life after operation.[1] In order to obviate as far as possible this condition an effort should be made to re-establish a flow of bile and pancreatic juice into the bowel and to assist in the elimination of the bile already in the blood and tissues. The line of treatment suggested in cases of impaction is of value here. I do not refer to the use of oil, but to the employment of daily lavage with hot soda solution and to the use of high enemas of hot and cold water, as detailed in the case of Miss D. B. These last in former years were in vogue in the treatment of simple catarrhal jaundice, and are often of singular efficiency in promoting reflexly a flow of bile into the bowel. Lavage with soda solution acts similarly and perhaps also directly by diminishing the duodenal and bile-duct catarrh. The laxative sodium salts are also employed for a similar purpose, as outlined previously in discussing the treatment of cholecystitis in the interval. With these, taraxacum in full doses is prescribed. A morning laxative dose only of sodium phosphate and sulphate may be administered, and nitromuriatic acid and taraxacum given a half-hour

[1] This hemorrhagic condition may be related to pancreatic hemorrhage occurring in many cases of acute pancreatitis. There is good evidence to believe that although the cholæmia is an important factor, it is not the sole one in the development of the tendency to bleed after operation, so often encountered in gallstone cases. Mayo Robson states that his experience in increased number of operations on deeply jaundiced subjects, teaches him that there is much less danger of serious bleeding in patients jaundiced from gallstones than in those in which the jaundice depends upon pancreatic disease.

before the noon and evening meal and at bedtime. The results obtained in the case of impaction previously cited (Miss D. B.) under this treatment were quite remarkable, considering how firmly the large calculus was fixed in the common duct by adhesions. Bile appeared in the stools, and the amount of urine was enormously increased. If with this treatment the stools remain persistently clay-colored, there may be reason to suppose that the obstruction is other than by a calculus. To also assist in the elimination of bile by the urine, when the remedies suggested have had little effect in directly promoting its flow into the bowel, it is worth while to employ benzoic acid or one of its salts—sodium or ammonium benzoinate. However its mode of action, that benzoic acid has an effect in hastening the resorption of bile from the tissues, and its excretion is well established.

For a few days prior to operation, after discontinuing the above medicaments, calcium chloride should be administered, with a view to heightening the coagulating property of the blood, and if necessary, during or immediately subsequent to operation, parenchymatous injections of gelatin. The sterile solution of gelatin should always be at hand for immediate use.

It is highly important that, following operation for chronic obstruction of the common bile duct, treatment be instituted to obviate, as far as possible, the ill effects of the long-standing bile stasis. The imminence of hepatic cirrhosis in these cases must be borne in mind. Apart from this grave condition there usually exists thickening of bile ducts and often a chronic gastroduodenitis. In the liver structural changes have likely occurred, due to the long-existing back-pressure of bile and, often, to coincident infection. Even if not structurally damaged, liver cells long accustomed to the passage of bile into the lymphatics do not readily assume normal function, and despite the removal of obstruction and free passage made for the bile, bile still, for a more or less lengthy period, finds its way into the circulation. A continued observation of these cases is, therefore, of prime importance, in order to correct the gastric and bile-duct catarrh, to obviate further bile stasis, and thus to restore the liver, as far as possible, to normal function. The state of the kidneys must also be carefully looked to.

The after-treatment should be largely on the lines already laid down for the management of chronic cholecystitis. In addition, mention must be made of the utility of certain other remedies in cases in which the jaundiced hue of skin persists. Here, apart from the measures cited for the treatment of the catarrhal condition, and in addition to attention to general hygiene, exercises, baths, and local applications, I have found the persistent use of ammonium chloride and taraxacum of great service. I often alternate courses of ammonium chloride with nitro-muriatic acid. My usual mode of administering these remedies is to

employ a morning laxative of sodium sulphate or phosphate and to give diluted nitromuriatic acid (10 to 15 minims in taraxacum, fluid extract or taraxacum juice, 1 to 2 drachms) before the midday and evening meal and at bedtime. A course of ammonium chloride (grs. xv–xx, three times daily) is alternated with the acid, and this salt is similarly exhibited in taraxacum, but is administered from one to three hours after meals.

PERITONITIS OF THE DUODENAL REGION.

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We may consider the various peritonitides as having regional significance. Thus, peritonitis of the pelvic region, or of the right iliac region, present peculiar features by which they have long been recognized. It is with chronic peritonitis of the duodenal region, or, more properly speaking, with the plastic adhesions following peritonitis of this region, that this paper will deal, with the view of calling attention to certain peculiarities of this form of abdominal disease.

By the duodenal region we shall understand that portion of the abdomen, bounded posteriorly by the descending limb of the duodenum, the inner aspect of the upper pole of the right kidney, and the common bile duct; to the inner side, by the mesocolon; to the outer side, by the gall-bladder and liver; above, by the liver and gastroduodenal junction; and in front, by the hepatic flexure, border of the liver, great omentum, and abdominal wall. This space, which we may designate as the duodeno-hepatic fossa, is, next to the pelvis and right iliac fossa, most prone to peritonitis. Every surgeon is aware of the frequency with which he encounters the results of peritonitis in this region, in the adhesions which he so often discovers in attempting to expose the duodenum or the common bile duct.

Although there are peculiar features which characterize acute peritonitis of this region, it is rather the result of such an acute inflammation, which gives rise to the chronic disturbances which are less well understood, and which are of sufficient frequency and importance to merit the attention of the surgeon and internist.

The causes of plastic peritoneal deposits in this region are about the same as the causes of acute peritonitis. The three conditions which deserve pre-eminent mention as causative factors are cholangitis; cholecystitis, with or without gallstones; and duodenal ulcer, with or without perforation. For the completion of the etiological category,

however, may be added the following: duodenitis; round ulcer of the pyloric region; carcinomatous ulcer of the pylorus, of the hepatic flexure, of the gall-bladder, or of the liver; perforating gallstones; hepatitis; perinephritis; appendicitis; pericolitis.

The extent of peritoneal adhesions, resulting from these conditions, may be very variable. The disturbances which they cause, however, are dependent more upon the location of the adhesions and the degree of distortion of the relations of organs which they induce. Thus, adhesions between the hepatic flexure of the colon and the gall-bladder may be depended upon to give rise to two distinct symptoms; constipation and attacks of dragging pain in the right hypochondrium, induced by overloading of the colon. It is not difficult to define the symptoms of deep adhesions about the duodenum. It is easy to conceive of their dragging upon the gall-bladder and adjacent organs, and giving rise to disturbances due either to angulation of visceral canals or to attacks of pain and tenderness from tension. When food is emptied into the duodenum there is a reflex contraction of the gall-bladder, and if a stone prevents the escape of bile, at just that particular time there occurs the pain which is so characteristic of gallstone. I have seen the gall-bladder dragged down by adhesions to such a degree that the angulation at the beginning of the cystic duct was capable of causing an obstruction which, in its symptoms, quite simulated those of gallstone obstruction. More frequently, however, the symptoms are only those of tension or traction, and are especially noticeable when the patient stands or when the alimentary canal is loaded.

A vast category of conditions of this kind may be described, and the number of combinations which may be effected is very large. Thus there may be adhesions, binding the hepatic flexure to the duodenum, to the gall-bladder, to the liver, to the omentum, to the stomach or to several of these organs. The gall-bladder may be attached to the hepatic flexure, the omentum, the pylorus, the duodenum—one or all. The pyloric segment of the alimentary canal may be adherent to the gall-bladder, the colon, the liver, or bound down to the descending portion of the duodenum. These are only a few of the combinations which may be effected by these adhesions.

As a rule, these conditions give rise to no tangible symptoms. In many cases slight symptoms exist which are very apt to be attributed to some other cause. And in a certain number of cases the symptoms are pronounced and even alarming. The condition which seems to give the most evident symptoms is adhesion of the pyloric region or first portion of the duodenum to the gall-bladder, liver or descending duodenum, in such a way as to cause an angulation which is aggravated when the stomach contains food. As a result of this condition

the patient presents the symptoms of pyloric stenosis; and unless the condition is relieved by the giving or stretching of the adhesions or by operation, the degenerative changes in the mucous membrane and the musculature of the stomach incident to this may be looked for.

Hemmeter[1] refers to cases in which the stomach was of normal size when empty, but was abnormally dilated when filled with food. In these cases there was an angulation just beyond the pylorus. The distention of the stomach had caused this kinking by traction. I shall report below three cases upon which I have operated during the past year illustrating this obstruction of the duodenum.

When the contents of the stomach encounter an obstacle to their easy entrance into the duodenum, according to the recent writers on pyloric obstruction, a sequence of three changes takes place. First, there is insufficiency of muscular power to overcome the obstacle, and the stomach suffers from the retention of contents which should normally be expelled; second, a compensatory hypertrophy of the musculature develops, which may or may not be sufficient to overcome the obstacle; and, thirdly, in the event of muscular failure, atony and dilatation ensue, with the accompanying degenerative changes in the mucous membrane.

The stage of insufficiency is not marked in ordinary cases of benign stenosis. It may not be noticed until some error in diet precipitates an attack, due to the inability of the narrowed lumen to accommodate the mass of food. An attack of pain occurs, and is quickly relieved by vomiting. Just this condition may not be observed again for weeks or months. The narrowed or angulated duodenum or pylorus still exists; and the stomach is gradually undergoing the dilatation which merges into atony. Finally, the stomach becomes unable to empty itself of solid food, and distress is constantly present after eating. Constipation usually coexists. The disturbances arising from these conditions involve the great category of digestive and general nutritive defects incident to pyloric obstruction and stomach dilatation, with its accompanying atrophy and degeneration of the gastric mucous membrane, fermentation, ptomaïne poisoning, and inanition. Because of the absence of free hydrochloric acid in these cases and the presence of pyloric obstructive symptoms, malignant disease may be suspected. The differentiation should not be difficult. In the benign obstruction there is often a history of cholecystitis, gallstone, or peritonitis of the duodenal region. In carcinoma, the stomach-contents show more fermentation, more lactic acid, and more lactic acid forming bacteria; the progress of the disease is steady; rectal feeding does not improve the patient to the same degree; there may be the dissemination signs

[1] Diseases of the Stomach, 1900, p. 660.

of carcinoma; the bloody vomit and the presence of cancer cells all help to make the diagnosis. In the benign obstruction the cachexia is simply that of starvation, with the possible addition of ptomaïn poisoning; water can usually be taken; and while there is usually no tumor, still I have seen a case in which the hypertrophy about the pylorus, and the matting together of the structures in the duodenal region, together with the contraction of the upper part of the rectus muscle, gave the impression of a very palpable tumor.

C. A. Ewald[1] speaks of the possibility of old peritonitis giving rise to cicatricial bands or adhesions dragging down the pylorus in such a way as to give pyloric stenosis. Also Van Valzan and Nisbet,[2] after enumerating external causes of pyloric obstruction, say that it may be caused "by constricting bands of fibrous tissue, resulting from peritonitis." And for duodenal obstruction they also give local plastic peritonitis.

The following cases operated upon myself, in the service of Dr. Pilcher in the Methodist Episcopal Hospital, serve to illustrate these conditions:

Case I.—R. E., male, aged thirty-six years. Well until three years ago. At that time, while living in Mexico, he had a fever with afternoon temperature of 41.5° C., lasting for two months. The liver was enlarged. There was no jaundice or pain. He became very weak and was confined to bed for four months. He recovered, and was apparently well until a year ago, when he began to have heaviness in the epigastrium and pain after eating. Later the pain was deferred for two or three hours after eating. These symptoms continued. He had to restrict his diet, and steadily lost flesh and strength. Seven weeks ago the pain suddenly became worse, and he was able to take only fluids after that time, but even these gave distress. Examination by Dr. Dudley D. Roberts showed atony of the stomach, absence of free hydrochloric acid, gastric stasis, and fermentation, tenderness over the duodenal region, and a dull sense of discomfort over the epigastrium and radiating to the right side. It was Dr. Roberts' judgment that the man was suffering from atonic gastritis and gall-bladder disease.

Operation. Duodenal region exposed by vertical incision through the outer border of the rectus muscle. Adhesions discovered connecting gall-bladder and neighboring under surface of liver to duodenum, omentum, and pyloric end of stomach. The common duct, cystic duct, and region of the transverse fissure were covered with adhesions. The gall-bladder was enlarged, distended, and adherent to the first portion of the duodenum. Its walls were apparently normal. No stone. The adhesions were divided to permit deeper exploration of the duodenohepatic fossa. The gall-bladder was opened, but the entrance to the cystic duct could not be discovered. With the collapsed gall-bladder out of the way the stomach was permitted to drop back into its normal position. Abdomen closed with a small tube in gall-bladder to drain

[1] Diseases of the Stomach. [2] Ibid., 1898.

off bile for a few days. Patient fed on peptonized milk for ten days, then other fluids. No solid food until the end of three weeks. At first the fluids caused some of the old distress. This gradually subsided, and when solid food was taken it was enjoyed. The patient was discharged at the end of four weeks able to take full meals of solid food without pain or discomfort, and steadily gaining flesh and strength.

The tropical fever from which this man suffered was probably complicated by angiocholecystitis with a spreading infection to the adjacent peritoneal surfaces. There were two pain-producing conditions—distortion of the beginning portion of the duodenum, causing angulation and obstruction; and dragging down of the gall-bladder, causing obstruction to the escape of bile by angulation of the cystic duct.

CASE II.—Male, aged fifty-two years. First symptoms began five years ago with pain referred to the stomach. This pain and feeling of discomfort in the epigastrium was almost constant. It was worse about half an hour after eating, and quickly relieved by vomiting. This continued for three months. He then placed himself under medical treatment and was much improved. Four years ago the same disturbances after eating returned, and have steadily grown worse. At the time of his admission to the hospital the pain after eating was severe. When the stomach was empty there was no pain. During the past four years he had lived almost exclusively on fluids. Solid food gave so much distress that he had desisted from taking it. For the past two years he had been failing in strength, and during the last year he had lost twenty pounds in weight. The symptoms were distinctly referable to obstruction to the passage of food from the stomach into the intestine. Bowels constipated.

Examination. Strongly built man. Abdomen thin-walled, scaphoid. Everywhere there is increased muscular rigidity. The most tender spot is just to the right of the middle of the epigastrium. Some tenderness to the left of the middle line. After eating the pain is referred to the right of the middle line. Board-like rigidity, giving a sense of tumor at this place. Absence of free hydrochloric acid.

Operation. Duodenal region exposed through vertical cut through outer border of rectus. Bands of adhesions connecting gall-bladder, stomach, and hepatic flexure were exposed. These adhesions had fixed the pyloric end of the stomach in such a position as to cause an angulation of the duodenopyloric segment of the alimentary canal, and thus a partial obstruction. These were divided and the above structures permitted to separate, exposing the descending duodenum, covered by the most dense adhesions. The gall-bladder was not thickened. The peritonitis which caused these adhesions had evidently originated from the duodenum. In this case a thickening, just inside of the pylorus, could be felt in the stomach wall; and to determine its character, the stomach was opened by a longitudinal incision, and the mucous membrane over the mass found perfectly normal and freely movable. I am not sure but that this was an hypertrophy similar to that of "stenosing gastritis" or "hypertrophic stenosis" of the pylorus, first described by Cruveilhier and Andrae. Although it was more of a localized patch of thickening, apparently in the muscularis. However, the wound in the stomach was closed transversely to its long axis to

relax and compensate for any obstruction which it is might have caused. The stomach dropped back into its normal position when the adhesions were liberated.

Rectal nourishment alone for five days. Then fluids were given by mouth, and the diet rapidly increased. On the fourteenth day solid food was taken with great relish and with perfect comfort for the first time in four years. By the end of three weeks he was allowed to take full meals of meat and vegetables, which he enjoyed without disturbance. Three months after his operation he was still perfectly well.

The most probable origin of this man's trouble was in a peritonitis transmitted through the walls of the duodenum, probably from ulcer.

CASE III.—Woman, aged thirty-one years. Trouble began two years ago with aching pain in the stomach after eating, lasting one or two hours. Nausea; no vomiting. She often noticed blood in the movements. This disturbance varied in intensity until six months ago, when she had a particularly severe attack lasting three weeks. This was characterized by pain in the epigastrium, coming on at variable intervals after eating from half an hour to two hours or more. The pains were cramp-like and cutting.

Examination of the stomach showed tenderness over whole organ, but especially at the pyloric region. The patient had been under treatment for gastric ulcer for three months with large doses of bismuth, bicarbonate of soda, peptonized milk diet, and rest in bed. Under this treatment the pain and tenderness had steadily subsided. She was fairly comfortable after getting up, but as soon as solid food was taken it precipitated another attack of pain. There was usually pain under the right shoulder-blade. The chief tenderness was over the duodenum. The gall-bladder was not tender. The history pointed strongly toward ulcer of the duodenum with peritoneal adhesions of the duodenal region.

Operation. Abdomen opened by cut separating fibres of right rectus muscle over duodenum. Rather extensive adhesions between gall-bladder, stomach, colon, and duodenum were found. The pyloric end of the stomach was bound closely to the gall-bladder and liver, causing a distortion of the duodeno-pyloric canal. These adhesions were divided and the stomach exposed and permitted to fall back into normal position. The adhesions were most dense about the duodenum and at the base of the gall-bladder. The gall-bladder was not thickened, and seemed normal except for the above-mentioned adhesions, and the fact that it contained thirty small stones without facets. These were removed. The bile-contents of the gall-bladder were normal.

The patient was allowed solid food at the end of seven days, and it was taken with great relish, and without any distress. After that the diet was increased until she was able to eat heartily and enjoy ordinary food without pain or dyspepsia.

In this case the later symptoms were accounted for by the distortion of the alimentary canal and its fixation by the periduodenal adhesions. The most dense adhesions were about the duodenum. It seems most probable that the peritoneal irritation which gave rise to these adhesions was of duodenal origin. Just what the relation to the sup-

posed duodenal ulcer may be, it is difficult to say. I believe that the gallstones had little or nothing to do with the symptoms.

It is reasonable to assume that these patients represent types of a large class of cases which have not received the study which their frequence and importance should demand. I am convinced that many of the cases of vague and intractable gastro-intestinal disturbances belong to this class. If the mechanical distortion of the alimentary canal is not corrected, a long chain of chronic digestive discomforts ensue.

Two questions remain to be settled: What will time and the yielding of adhesions do for these cases? and what has surgery to offer? The first question is difficult to answer because of the difficulty of making a positive diagnosis without operation. That surgery offers relief to these cases the above reports would tend to show; although in all of these new adhesions will certainly form. The operation can only liberate the parts from their disturbed relations, and place them in such position that it may be hoped that the new adhesions shall be less vicious than the old.

A CONTRIBUTION TO THE STUDY OF THE HUMAN BLOOD PRESSURE IN SOME PATHOLOGICAL CONDITIONS.*

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It is only within the last few years that the study of the arterial blood pressure of the human economy in its relation to clinical pathology has been investigated at the bedside, or allotted a space in textbooks of medicine. The chief reasons for this are, perhaps, the following: 1. The intricacy and complexity of the whole subject of blood pressure, which, even in a healthy individual, fluctuates more or less continually and is influenced by so many and diverse causes. 2. The difficulty of estimating the pressure with sufficient accuracy and rapidity to make the investigations statistically useful and clinically practical.

A number of instruments have been devised in an attempt to fulfil the foregoing requirements which may be classified thus:

1. Those which estimate the pressure by noting the return of color to the skin, which has been previously rendered anæmic by pressure—*e. g.*, Gärtner, von Kriess, Marey.

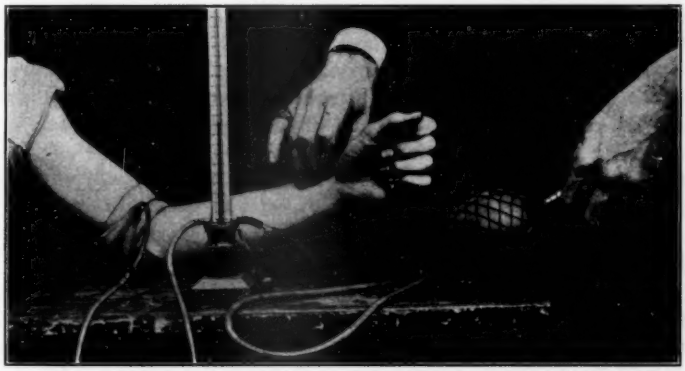
2. Those which gauge the pressure, using as a standard the amount of compression necessary to obliterate the distal pulse in the arm or leg—*e. g.*, Riva-Rocci, Vierordt, von Basch.

* Read before the College of Physicians of Philadelphia, Feb. 9, 1903.

3. Those fashioned like the instruments of Mosso and Barnard and Hill, which select the point of greatest arterial oscillation as the pressure index.

The following observations were made upon cases at the Pennsylvania Hospital, occurring in the services of Drs. Morris J. Lewis, Frederick A. Packard, Alfred Stengel, and J. A. Scott.

The readings were taken from the right arm of the patient, on different days, but as nearly as possible at the same hour of the day and in the same (usually recumbent) posture. The instrument used was that designed by Riva-Rocci, who, upon making comparative tests upon animals coincidently with it and with a manometer directly connected with the arterial stream, found the readings to closely correspond; those of the manometer being pretty constantly from one to two cubic millimetres of mercury lower.



The Riva-Rocci hæmodynamometer.

The investigations of Perthes and Hensen have corroborated these results. The latter finding in experiments on the cadaver close accuracy in the readings, "provided there was no rigor mortis or œdema" present. It is only fair to add, that all observers have not found such equally good results; but, on the whole, those obtained with this instrument by different investigators, when compared to the actual manometrical pressure, have shown fewer discrepancies than has been the case with other forms of apparatus.

The Riva-Rocci instrument consists, as is shown in the accompanying photograph, of a hollow rubber cuff, rendered outwardly inexpansile by a snugly fitting covering of muslin and a metallic band. The interior of the cuff communicates by means of rubber tubing with a manometer and a syringe bulb. When in use the cuff is slipped over

the hand, applied to the arm just above the elbow, adjusted approximately to the size of the arm, and secured. Sufficient air is then pumped into it to occlude the radial pulse, and as soon as this is accomplished the air is gradually allowed to escape until the arterial impulse is once more perceptible to the palpating finger at the wrist, at which point the reading is taken from the manometer scale in mm. of Hg.

Reflection leads one to the belief that the condition of the soft parts —thickness of the skin, muscular tonus, density of the arterial wall, etc.—must have more or less effect on the accuracy of the readings. However this may be, there can be no doubt of the value of sphygmanometric observations in comparing the fluctuations of pressure in the same individual; and it may be asserted with equal certainty that by carefully selecting individuals for purposes of comparison, and having a sufficiently large number of cases under observation, conclusions may be drawn probably not much at variance with actual existant conditions.

Just as the study of thermometry, though known at an earlier date, lacked utility until Wunderlich, from a large number of statistics, was able to establish its importance in clinical medicine, so it is only by repeated observations carefully made and frequently repeated that we can hope to derive diagnostic or prognostic aid from the study of blood pressure; a subject still relatively in its infancy, and one which is not only replete with interest but of the greatest importance in all vital phenomena.

The *normal pressure* as indicated by the Riva-Rocci apparatus is, according to Gumprecht, 140 mm. for men and 120 mm. for women, while Hensen's estimate is 137 mm. and 132 mm. The figures here appended are the pressures recorded of a healthy man, aged twenty-seven years, in the sitting posture under approximately similar circumstances upon different days, and show a marked tendency to uniformity: 120, 108, 122, 118, 132, 134, 130, 130, 125, 125, 120.

Physiology. It may not be amiss to consider cursorily a few of the more important factors concerned in the maintenance of physiological blood pressure.

Primarily arterial pressure (for practically we may overlook that of the venous system) can be said to depend upon:

1. The force and frequency of the cardiac contractions.

2. The amount of resistance in the bloodvessels, which is chiefly determined by: (*a*) The vasomotor centre in the medulla; (*b*) the state of the splanchnics; (*c*) peripheral sensory reflexes acting through the medullary centre; (*d*) the state of the muscular system.

3. Respiratory movements—inspiration increasing and expiration

decreasing the tension—which is in turn accomplished by: (*a*) The tension and velocity of the lesser circulation; (*b*) the suction of the large veins; (*c*) the intra-abdominal pressure; (*d*) the contraction of the heart; (*e*) nervous stimulation.

4. Posture—different observers have arrived at opposite conclusions: some asserting that pressure is highest when recumbent and lowest when erect, others that the reverse is the case.

It is a well-known fact that blood pressure varies more or less constantly, not only in different, but even in the same individual. In addition to variations due to such well-recognized causes as posture, gravitation, exercise, altitude, temperature, digestion, etc., periodic fluctuations of but a few seconds' duration and of sufficient intensity to cause in rabbits an increase of 20 mm. to 30 mm.—Traube's waves—are observed. This variation of pressure is based upon a periodic diurnal fluctuation, and, like the pulse rate, the secretion of urine, the elimination of CO_2, etc., rhythmically recurs independent of the ingestion of food, and bearing no apparent relation to cardiac or respiratory activity.[1] It is usually highest during the afternoon and sinks toward evening (Hensen). That such fluctuations in tension occur in man has been shown by Mosso[25] and von Pfungen.[16] Zadek[2] gives the average daily fluctuation, from different causes in man, as from 8 mm. to 15 mm. Blood pressure also differs according to sex and age, being lower in women than in men; and lowest at birth, from which time it steadily increases until maturity is reached.

Manifestly, as a result of the cardiac contractions, three different states of blood pressure must exist: the systolic (highest), the diastolic (lowest), and the mean pressure. The latter is, of course, the most important, because upon it depends the hæmic velocity; nor is its relation to either of the two first mentioned pressures a constant one. For example, the mean pressure would be much nearer the systolic pressure in a case of mitral stenosis, in which the volume of the pulse is small and the pressure high, than in aortic insufficiency, in which the volume is large and the tension low.

Since the completion of my observations a modification of the Riva-Rocci apparatus has been completed, through which by means of an indicator and a recording drum the whole pressure curve can be graphically reproduced. Owing to the lack of such an instrument I have had to content myself with obtaining records of the systolic pressure, a method which, while, as has been said, it is open to objections, yet may in the majority of cases be looked upon as a fairly reliable index.

The *normal amplitude* of the pulse wave is given by Hensen[3] as ranging from 5 mm. to 20 mm. of Hg. The same author gives as the limits

within which human life is possible from 70 mm. to 266 mm., though he has recorded one case in which life was sustained for a short time with a pressure of only 55 mm. The largest diurnal variations occurring in a healthy man have, I think, been reported by Burkhart,[4] who found in an individual a difference of 40 mm.; the pressure being highest at 1 P.M. and lowest at 3 P.M.; and by Hensen who noted a daily fluctuation of 50 mm. Cook[24] has found the lowest pressure between 3 and 4 A.M.

It is generally conceded that while abnormally high pressure may be borne for a long time without seriously interfering with the vital functions, abnormally low pressure if it continues for any length of time usually means death. In this connection Cushing[5] has pointed out the fact that by regularly charting the blood pressure during anæsthesia the oncome of shock may be anticipated and prevented in the course of surgical procedures.

With regard to the process of *digestion*, Columbo, Weiss,[17] and von Recklinghausen[6] have found the pressure to be highest just before the midday meal, with a gradual fall while digestion was in progress. The well-known irritability of animals and human beings, when the dinner hour is delayed or missed, may bear some relation to this increase of arterial tension; for it is also known that people who suffer from gout (and are usually irascible) and from agitated melancholia (*vide* Alexander, *Lancet*, July 5, 1902) are usually the subjects of a tense arterial wall.

The influence of *psychic activity* is a potent one. Von Recklinghausen noted in his own person an increase of 14 cm. of water when someone entered the room with whom he desired to speak. Gumprecht[7] found an increase of pressure to be produced by anger and scolding, which again corresponds to the tendency of apoplexy to occur during fits of rage.

Von Basch[8] has reported a series of 120 cases, with hypertension, of whom 7 died of apoplexy; and Hensen 12 cases, of which 6 were similarly afflicted. I have observed in my own radial artery an increase of 10 mm. of Hg produced by carrying on an animated conversation.

Muscular exertion causes an elevation of blood pressure, but if it be carried on until cardiac fatigue supervenes it again falls and eventually becomes subnormal (Schott[18]), an admirable conservative process on the part of nature by which acute cardiac dilatation is avoided.*

The *normal range* of tension, as shown by the Riva-Rocci instrument, lies between 100 mm. and 160 mm. No definite relation has as yet been

* For the discussion of the means by which this is brought about the reader is referred to Guntz's article, "Handbuch der Physik. Therap.," Band II., Th. I.

established between pulse rate and blood pressure, nor is it uncommon to find the latter higher in the right arm than in the left.

PATHOLOGY. The lowest pressure met with is usually seen in shock, in convalescence from fevers, in acute cardiac asthenia, in cachexia, and in the agonic periods. The highest limits of tension are, as a rule, observed in cases of chronic interstitial nephritis, either with or without arterio-sclerosis. Hypertension is much more common than hypotension, which has usually a more serious portend; and all observers agree that pre-agonic fall of pressure does not occur long before death itself supervenes.

According to Hensen, cases with a pressure below 70 mm. terminate fatally; and even though the tension fall but as low as 90 or 95 mm. and be accompanied with untoward symptoms, a bad prognosis is augured.

In several cases I have seen a rise of 10 mm. to 15 mm. accompany the occurrence of paroxysmal *pain*, and disappear with subsidence of the attack. Such an event was observed in two cases of saturnine colic, and in one case of hypertrophic hepatic cirrhosis. In these cases the rise of tension was probably due to vasoconstriction resulting from stimulation in the medullary centre, produced by peripheral sensory impulses.

Potain[19] states that as a general rule *low tension* occurs in typhoid fever, pulmonary tuberculosis, and in acute and chronic articular rheumatism.

Moderate tension in pneumonia, pleuritis, febrile gastritis, chlorosis, hemorrhages, organic heart lesions, and in diseases of the arterial system.

Very high tension in interstitial nephritis, arterial atheroma, and in diabetes.

According to Oliver,[20] hypertension is observed in certain neuroses, chronic goutiness, renal disease, heart disease of peripheral origin, irritable skin affections, anæmia, obesity, and endarteritis.

As will be seen from the following table of cases of enteric fever, the blood pressure tended to be subnormal throughout the whole course of the disease, it being highest during the fastigium and lowest during convalescence. That the higher pressure noted in the former state was not due merely to increased temperature is shown by Case No. 21, in which relatively high pressure existed with little fever, and in Case No. 26, in which the reverse condition obtained. These results accord pretty closely with those of other observers, it having usually been found that pressure rises with temperature, but falls if the fever be long continued (Arnheim[9]), or if cardiac weakness is present (Zadek[2]). How deceptive may be the tactile sensation was shown by a number of

cases in which the pulse was described as very soft and dicrotic, whereas by actual measurement it was found to be of higher tension than later in the disease, when the sensory impression of weakness was less marked. Observations were made upon a much larger series of cases than have here been tabulated, and in a number, measurements were made upon the same patient every few days throughout the course of the disease, but the findings were of such uniform character that further tabulation has seemed unwarranted. No definite relations could be established between pressure and prognosis, either as regards the eventual outcome or concerning the likelihood of hemorrhage or perforation to occur.

Potain[19] has pointed out the fact that a prolonged fever with blood pressure persistently subnormal should make us strongly suspect typhoid fever.

TYPHOID FEVER.

No.	Name.	Sex.	Age.	Press.	Pulse.	Resp.	Temp.	Stage of disease.	Remarks.
1	L. B.	M.	10	110	100	28	102°	Incipient.	
2	A. S.	M.	30	115	80	24	100	"	
3	A. W.	M.	36	118	88	24	101	"	Ill four days.
4	J. C.	M.	18	105	88	24	101	"	Ill eight days.
5	2171	M.	20	130	92	24	101 2/5	"	Malaise eight days First day in bed.
6	B. C.	M.	25	125	80	24	104	"	Malaise two days. First day in bed.
7	2677	M.	16	98	100	26	102	"	
8	T. H.	M.	28	139	96	24	102	Fastigium.	Very robust man.
9	K. K.	F.	31	112	130	26	104	"	
10	B. B.	F.	24	132	118	26	102	"	
11	V. P.	M.	28	101	90	26	102	"	
12	C. L.	M.	25	125	96	24	102	"	
13	J. H.	M.	17	108	90	24	100	"	
14	J. N.	M.	19	100	102	24	99	Defervescence.	
15	M. D'F.	M.	18	118	72	24	99 2/5	"	Slight attack.
16	A. E.	M.	50	95	84	24	98 4/5	"	Severe illness.
17	D. O.	M.	29	106	72	24	100	"	Slight attack.
18	F. F.	M.	19	98	76	20	100	"	" "
19	M. T.	F.	32	108	98	24	99	"	
20	S. W.	M.	10	92	108	24	99 3/5	"	
21	P. R.	F.	24	135	90	24	98 4/5	"	
22	M. A.	M.	17	118	60	24	98	Convalescence.	Moderate attack.
23	J. H.	M.	17	102	88	24	98	"	Slight attack.
24	S. F.	M.	27	109	74	24	98 2/5	"	Moderate attack.
25	J. C.	M.	14	95	70	22	97 3/5	"	Severe attack.
26	F. S.	M.	30	96	128	24	103	Relapse.	
27	P. W.	M.	29	106	88	24	98	Convalescent.	
28	J. K.	M.	24	93	56	20	96	"	

Two cases of *paracolon* infection which were under observation from time to time during the course of the disease showed low tension—117, 110—during the fastigium, and still lower readings during convalescence.

For a more comprehensive and detailed study of the blood pressure in typhoid fever, the reader is referred to the careful analysis of 150 cases by Alezais and François.[10]

CROUPOUS PNEUMONIA.

No.	Sex.	Age.	Press.	Pulse.	Resp.	Temp.	Remarks.
431	M.	30	130	84	48	100	Urine—albumin and casts.
523	M.	50	145	112	40	102	Arterio-sclerosis; parenchymatous nephritis.
549	M.	34	125	84	24	98	
725	F.	23	130	74	24	98	
976	F.	37	100	102	24	103	Two days before crisis.
431	M.	30	130	80	48	98⅘	Lysis.
310	M.	40	115	64	24	98	
	F.	8	105	120			
	F.	34	165	68	...	...	Double mitral disease; miscarriage twelve hours before.
	F.	27	115	106	28	102⅘	

The causes which influence arterial tension in croupous pneumonia are even more complex than in other fevers. As will be seen from the foregoing table no constant relations seem to exist. In nearly all the cases readings were made before and after the crisis. In Case No. 523 a critical drop of 15 mm. occurred, but the remaining cases showed only slight variations. Zadek[14] has reported three cases of pneumonia in which, at the time of crisis, pulse temperature and tension fell coincidently; and Christeller[21] with the von Basch instrument has recorded a drop of 40 to 50 mm. after the crisis of high fevers. The discrepancy between my results and those just mentioned may, perhaps, be due to the fact that the pressure was in some cases not taken until two or three hours after the temperature had fallen. In considering the state of the blood pressure in this disease it must be borne in mind that, as H. C. Wood, Jr.'s[22] experiments have demonstrated, blood tension in the lesser and in the greater circulation are not necessarily coincident—hypertension may exist in the systemic circulation, the pressure in the pulmonary arteries being at the same time normal, and *vice versa*.

NEPHRITIS. In the *interstitial variety* of this disease the blood pressure was found uniformly above the normal, in some cases extraordinarily so; and, while many of them were complicated by arterio-sclerosis, several occurred in individuals in whom this condition was at least not recognizable to the touch. In none of the cases here tabulated was there present any œdema of the arms which could add to the apparent height of the pressure. All the cases observed in uræmic coma had very high tension. In a number of instances fall of pressure, under treatment, was accompanied with a diminution of albuminuria and well-marked amelioration of symptoms. These facts are corroborated by the investigations of Carter,[12] who found the mean average pressure in this variety of nephritis 62 mm. higher than in acute nephritis. The foregoing results, moreover, accord closely with

the findings of nearly all investigators, as well as with facts clinically long well known.

CHRONIC INTERSTITIAL NEPHRITIS.

No.	Name.	Sex.	Age.	Press. c.m	Pulse.	Remarks.
1	T. B.	M.	40	175	90	
2	T. C.	M.	49	235	65	Pressure fell under treatment to 168, the albuminuria coincidently decreasing.
3	S. T.	F.	54	250	84	Death from uræmia. Autopsy confirmed diagnosis.
4	A. V.	F.				
5	A. Z.	M.	50?	250	104	Death from uræmia.
6	F. P.	M.	37	165	76	
7	E. N.	F.	60	164	70	Arterio-sclerosis.
8	P. Y.	F.	49	250	68	Slight arterio-sclerosis.
9	H. G.	M.	45	210	70	Arterio-sclerosis; valvular heart disease.
10	D. D.	M.	63	225	124	Arterio-sclerosis.
11	J. R.	M.	...	160	...	Myocarditis.
12	J. S.	M.	24	220	92	Retinal hemorrhages. Under treatment pressure fell to 162, with a coincident decrease in albumin. Died, after Edebohls' operation, from uræmia.
13	398	M.	50	180	70	
14	699	M.	58	166	64	Had had two attacks of angina pectoris.
15	1915	M.	58	175	70	Marked nodular arterio-sclerosis; myocarditis.
16	3618	F.	62	224	80	Marked arterial thickening.
17	3787	F.	72	190	100	Marked sclerosis; right-sided hemiplegia nine months before.
18	557	M.	45	160	100	
19	S. L.	F.	57	285	80	Marked atheroma; hemiplegia.
20	A. F.	F.	62	260	88	
21	A. V.	F.	60	185	88	Arterio-sclerosis; organic heart disease.

Most observers have found an approximately normal arterial tension in *chronic parenchymatous nephritis*. The few results here tabulated of this disease show a decidedly subnormal pressure, which is probably in part due to the poor physical condition of the patients, but certainly indicate an enormous difference between this condition and that arising from contracted kidneys.

CHRONIC PARENCHYMATOUS NEPHRITIS.

No.	Name.	Sex.	Age.	Pressure.	Pulse.	Remarks.
1	M. M. . . .	M.	25	103	80	
2	P. A. . . .	M.	45	100	68	
3	M. B. . . .	F.	39	105	116	Tachycardia.
4	D. E. . . .	F.	23	122	88	Mitral insufficiency.
5	R. S. . . .	M.	45	115	72	
6	W. E. . . .	M.	39	110	88	
7	D. P. . . .	M.	18	120	80	
8	2642 . .	M.	52	140	108	

ARTERIO-SCLEROSIS. It is, of course, impossible to draw an absolute line between sclerotic and non-sclerotic arteries by the unaided tactile sense unless the condition is well advanced. Again, in the results obtained much will depend upon the location of the greatest arterial thickening. Thus, pressure will be much higher if the splanchnics or the small systemic vessels are involved than if the former are relatively normal or the induration chiefly confined to the larger arteries. The

following observations were made upon cases in which well-marked radial sclerosis was present, in patients in whom so far as was ascertainable no other determining pathological condition existed. In considering the results, allowance must be made for a certain amount of error, arising from the resistance to compression, of the stiffened arterial wall itself. This resistance has been estimated by von Basch at 5 mm. as a maximum for the radial. Hensen's figure, based on rather unsatisfactory reasoning, is 20 mm. for the human brachial artery. So far as I know no conclusive experimental work has been done on the subject. The problem is certainly a complex one, for co-existent with arterial degeneration a variable amount of myocarditis and nephritis is usually present, each of which conditions are notably accompanied by high tension. The fact that some cases of marked arterio-sclerosis have an approximately normal pressure would rather seem to indicate that the stiffness of the vessel wall cannot have much effect upon the height of the tension recorded.

ARTERIO-SCLEROSIS.

Name.	Sex.	Age.	Pressure.	Pulse.	Diagnosis.	Remarks.
E. E.	F.	78	218	84	Fracture of femur.	Arterio-sclerosis very marked.
E. M.	F.	60	222	80	Infected wound of leg.	" " marked.
S. M.	F.	70	168	66	Fracture of leg.	" " moderate.
M. M.	F.	80	185	88	Dislocation of shoulder.	" " marked.
E. N.	F.	60+	164	70	Vertigo.	Moderate arterio-sclerosis.

SATURNISM. The tendency of chronic plumbic intoxication to produce interstitial nephritis and arterio-sclerosis is well known. That the condition is usually accompanied by high arterial tension seems to be likewise accepted as a fact. Whether this occurs only secondarily after changes have been wrought in the kidneys and vessel walls, or whether the lead itself exercises a constricting action upon the vascular system, has not been definitely determined, though the evidence points toward the latter conclusion. In two such cases reported by Christeller[14] there was noted as the result of treatment a considerable (10 mm., 30 mm.) decrease of tension. A similar event occurred in a number of my cases in which the elimination of lead from the system and the decrease of blood pressure seemed to progress hand in hand. To be sure, rest in bed, the relief of pain, and the administration of potassium iodide—which Jodbauer[15] believes to be an arterial depressant—would of themselves account for a certain amount of vascular relaxation; but as the tension continued to diminish after the first two factors had ceased to be active, and as the power of the iodide to lessen pressure is not a great one, it would appear that the lead *per se* must exert a positive influence. Plumbic intoxication stands third in the

list of factors which produce high pressure; and, as Hensen remarks, "in a case continued of hypertension without demonstrable cause we must, besides arterio-sclerosis and chronic nephritis, investigate the possibility of lead poisoning."

LEAD POISONING.

Name.	Age.	Press.	Pulse	Resp.	Occupation.	Localization.	Attack.	No. yrs. at work.	Urine.	Remarks.
1943	21	185	80	20	In lead works.	Colic.	Second	1	Negative.	
J. B.	24	180	84	25	Painter.	Encephalopathy.	First	Unk.	Albumin.	
631	28	118	92	20	Painter.	Colic.	Second	10	Albumin.	Convalescent.
W. V.	48	194	58	18	Paint works.	Colic.	.....	...	Negative.	
486	36	150	80	24	Painter.	Colic.				
St.	48	142	60	32	Painter.	Wrist-drop colic.	Second	15	Trace alb.	
J. S.	36	150	74	20	Painter.	Colic.	Fifth	24	Trace alb.	
J. K.	21	148	90	20	Lead works.	Colic.	Second	...	Negative.	
A. A.	38	170	72	24	Hide dyer.	Colic.	Second	...	Negative.	

HEART DISEASE.

No.	Name.	Sex.	Age.	Press.	Pulse	Remarks.
1	W. R.	M.	18	112	100	Mitral regurgitation and stenosis.
2	M. H.	M.	23	128	90	" " " "
3	G. L.	M.	45	122	80	" " " "
4	B. F.	F.	30	142	64	" " " "
5	G. McM.	M.	35	125	100	Mitral regurgitation and stenosis; pericarditis; parenchymatous nephritis.
6	W. McL.	M.	20	108	84	Aortic and mitral insufficiency.
7	S. G.	M.	16	120	115	Aortic insufficiency, hypertrophy, adherent pericardium.
8	L. C.	F.	40	120	100	Mitral and tricuspid insufficiency.
9	C. F.	F.	37	145	100	" " " "
10	J. K.	M.	50	135	94	Mitral and aortic insufficiency.
11	P. H.	M.	13	88	...	Mitral stenosis.
12	401	F.	39	105	116	Tachycardia, neurasthenia.
13	W. L.	M.	50	166	72	Angina pectoris twenty-four hours after attack.
14	J. M.	M.	22	117	106	Pericarditis, endocarditis, pleuritis.
15	G. B.	M.	42	180–80	...	Myocarditis, nephritis.
16	G. McM.	M.	35	115	98	Pericarditis, double mitral lesion.
17	M. C.	M.	38	138–115	68	Myocarditis, nephritis.
18	A. de B.	M.	26	125	128	Pericarditis, femoral thrombosis.
19	A. M.	F.	25	128	64	Mitral insufficiency.
20	753	M.	13	92	90	Acute endocarditis.
21	1641	M.	30	104	52	Acute endocarditis, due to B. typhosus; no intestinal lesions.
22	428	M.	20	100	84	Aortic and mitral insufficiency: pulmonary embolism.
23	Z. P.	M.	35	130	116	Mitral insufficiency and stenosis.

Considering the wide limits within which functional variations of tension may occur, it is hardly strange that still greater fluctuations should exist in cases of organic lesion such as are met with in cardiac disease. Certainly it is a fact, that, as remarked by Potain in his book on *Sphygmanometry*, "in cardiac disease we will find great variations of pressure." This applies not only to the differences of tension which

occur in contrasted individuals suffering from the same malady, but refers as well to the marked daily and hourly fluctuations which are seen in the same person. The cases here tabulated are, of course, too few, too diverse, and too much complicated by co-existent pathological conditions to alone furnish a basis for deductions, but from a study of them, together with an investigation of all the literature upon the subject which has been at my disposal, the following statements concerning heart disease seem warranted:

1. Daily and hourly variations of tension are commoner and greater in amount than in health or in other afebrile pathological conditions unaccompanied by heart disease.

2. In *mitral insufficiency* the pressure is usually normal, it may be subnormal, but is rarely supernormal in uncomplicated cases.

3. In *mitral stenosis* tension tends to be higher than in insufficiency, and when both lesions are present it tends to be higher than when the latter condition alone exists, provided that compensation is fairly good.

4. In *aortic insufficiency*, especially if compensation is good, the systolic pressure is above normal, often markedly so. The wave amplitude is much greater than normal (one of Hensen's cases showed a systolic pressure of 150 mm. and a diastolic pressure of only 50 mm.). The greatest amount of daily individual fluctuation occurs in this variety of heart disease. The pressure does not fall below the normal unless the lesion is complicated by mitral disease or myocarditis (Potain).

5. *Myocarditis* is usually accompanied by high tension, and cardiac *dilatation* by low tension.

6. No constant relation exists between *pulse rate* and blood pressure.

It is doubtful if any rules can be laid down as to the relation of arterial pressure to the integrity of compensation. Potain, it is true, believes that in a general way the more nearly tension approaches the normal the better will it be, but this statement is, to say the least, open to many exceptions, and in numerous ones of my cases this was by no means the case. The above-mentioned author asserts that in heart disease a fall of pressure is always an unfavorable sign; this is, of course, especially the case when dilatation exists, and has been substantially exemplified through the careful researches of Schott,[21] who, in the course of his Nauheim treatment, has produced demonstrable diminution of cardiac dilatation, and has showed this to be coincident with an increase of arterial tension and of physical well-being.

The following table is fairly illustrative of the diurnal fluctuations which commonly occur in cardiac disease. The patient was during the greater part of these observations in bed, and taking small doses of glonoin, the administration of which, so far as sphygmanometry would indicate, was uncertain in its effects. This test of the therapeutic efficacy of the drug is not a fair one, inasmuch as the dosage

was small and infrequent, and because the observations were made without any constant relation to the time of its administration.

MITRAL STENOSIS.

Observations on different but not always consecutive days.

142	175	155	150	150	135	132	140 (erect)	120	130 (erect)	120 (erect)

The foregoing pressure readings were made upon a woman, aged thirty-eight years, who had had numerous attacks of rheumatic fever, and in whom stenosis was marked and accompanied by some insufficiency.

A fact that must not be overlooked in sphygmanometrical observations upon cases of heart disease is, that we are in these particularly likely to err on account of the irregular force of the systolies.

MISCELLANEOUS CASES.

Diagnosis.	No.	Sex.	Age	Press.	Pulse	Resp.	Temp.	Remarks.
Catarrhal jaundice	417	F.	39	112	76	24	98°	
Cholecystitis	20, 38	M.	38	170	60			
Catarrhal jaundice	18, 81	F.	44	110	100			
Cirrhosis of liver	.....	M.	49	130	84	...	.....	Jaundice, nephritis.
Emphysema	21, 21	M.	65	120	86	20	98⅘	Bronchitis.
Asthma	.....	M.	49	153	90	26	.....	Arterio-sclerosis, hay fever.
Acute nephritis	20, 15	M.	9	135	80			
Cancer, pancreas	.....	M.	40	125	80	20	98⅗	Jaundice marked.
Malaria	454	M.	21	100	80	20	98⅘	Between paroxysms.
"	770	...	24	95	...	...	.....	" "
"	P. P.	M.	34	100	64	...	96⅗	" "
"	T.	M.	37	150	132	...	102	During chill.
"	T. de B.	M.	19	125	76			
"	V. P.	M.	37	118	98	...	100	
"	19, 46	M.	41	138	92			
"	19, 45	M.	25	105	72			
"	19, 47	M.	49	105	86			
"	454	M.	21	100	80	20	97⅗	Between paroxysms.
	468	M.	19	130	70	20	98	" "
Rheumatic fever	B. K.	F.	18	110	88			
" "	B. K.	F.	13	118				
" "	465	M.	24	140	120	24	103	Rheumatic fever, erythema multiforme.
" "	376	M.	36	150	80	20	99	Rheumatism.
" "	21, 89	M.	16	115	60	24	99	
Fracture of skull	M. B.	M.	43	145	92	20	97⅘	Fracture of vault; no symptoms.
Chronic rheumatism	516	M.	28	125	70	20	97	

Some remarks upon the foregoing miscellaneous cases are, perhaps, not out of place. It will be noticed that two cases of catarrhal jaundice were accompanied by hypotension.

But little information was obtained from cases of malaria. Repeated observations were made upon the same individual before, during, and after the chill, without any definite relations being established; the tension varied but little despite the wide fluctuations of temperature.

The same may be said of rheumatic fever, and tends to corroborate Mosen's[13] statement that blood pressure bears no constant relation to temperature.

Cases of Individual Interest.

CASE I.—J. J., a male negro, aged thirty-six years, had been treated in the ward for some time for aortic and mitral insufficiency complicated with parenchymatous nephritis. One morning he was found semiconscious, and it was immediately noticed that the man had a right-sided hemiplegia, with Cheyne-Stokes respiration. Before the onset of the paralysis the blood pressure had ranged from 130 to 150, the patient usually feeling better when it was high. While the Cheyne-Stokes syndrome persisted there was invariably a considerably (10 mm. to 25 mm.) higher tension during the dyspnœic than during the apnœic periods.

					Cheyne-Stokes resp.					
150	130	142	142	142	A. 155 D. 180	138 155	135 150	145	128	122

CASE II.—A man, aged fifty-two years, suffering from parenchymatous nephritis, moderate atheroma, and Cheyne-Stokes respiration, showed tension of 155 during dyspnœic and 140 during apnœic periods,

Numerous similar cases have been reported.

CASE III.—P. B., male, aged forty-six years, aneurism of the aorta was diagnosed; the patient improved and left the hospital.

Right radial . . .	144	156	150	150	140	132	131	130
Left radial	134	146	140	140	130	122	121	122

CASE IV.—A female, aged fifty-seven years, marked atheroma, chronic interstitial nephritis; right-sided hemiplegia. On several successive days the blood pressure in the right arm was 285 mm., while that in the left was 245 mm. Pulse 80.

A similar case in a man, aged forty-four years, who also had right-sided hemiplegia. Pressure in the right arm 146 mm.; in the left 136 mm.

CASE V.—Jennie B., aged thirty years, pleural effusion. Pressure, 110 mm. Two days after aspiration of fluid 98 mm.

CASE VI.—Helen K., aged forty years, atrophic hepatic cirrhosis, with ascites. Pressure, 153 mm. After paracentesis abdominalis, 148 mm. A few hours before death 109 mm.

CASE VII.—William J., aged forty-five years, interstitial nephritis. Pressure, 185 mm. After hot pack, temperature 170 mm.

In the present state of our knowledge the height of the blood pressure cannot be said to be a useful index in regard to the potency of the systemic circulation, nor is it a criterion of sufficient constancy to be used as a basis for prognosis. The pressure index may, in some instances, be regarded as a relative indication for treatment. What, as a rule, we require to know is not so much the actual height of tension as the amount and character of its fluctuation. We have seen that a fair state of nutrition may be carried on in the convalescence from typhoid fever with a tension of 85 mm., and in arterio-sclerosis at 180 mm.

In conclusion, I wish to acknowledge my indebtedness to the late Dr. Frederick A. Packard, at whose suggestion I undertook the foregoing investigations, and whose noble example I shall always cherish in memory as the type of what is highest and best in the medical profession. A doctrine which Dr. Packard always sought to inculcate in the minds of the younger men was: that it is the duty of every practitioner to contribute his share, however small, to the advancement of medical knowledge; and it is with the hope of its proving of some value in the ultimate solution of the great problem of hæmodynamics that this short study has been brought to publication.

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REVIEWS.

MATERIA MEDICA, THERAPEUTICS, MEDICAL PHARMACY, PRESCRIPTION-WRITING, AND MEDICAL LATIN. By WILLIAM SCHLEIF, Ph.G., M.D. Second edition, revised and enlarged. Philadelphia and New York: Lea Brothers & Co.

THE author has succeeded in condensing an astonishing amount of information in the comparatively small compass of this book. It is for the student's benefit, no doubt, that many remedies now of purely historical interest have been retained. We note the statement that veratrum viride is given in the early stages of pneumonia, a myth that has been taught and will, we doubt not, continue to be taught to generations of confiding students; yet who ever heard of its being actually used in practice? But if the author may be criticised for excessive conservatism in this respect, he has at least omitted none of the important newer remedies, and, except for the very newest, which are found in a special list and are briefly and impartially mentioned with little or no critical comment, have been, with excellent judgment, included in the same group with the old-established drugs. It is to be regretted that the group of coal-tar antipyretics has been accorded such favorable notice. Antipyrin, it is true, is encumbered with a caution as to the possibility of medicinal doses causing "serious depression;" nevertheless, it is distinctly recommended in typhoid and pneumonia "whenever it is evident that the elevation of temperature of itself is harming the patient." Not to dwell on the difficulty of determining when this indication is present, it is now generally held, and ought to be as generally taught, that these drugs have no place in the treatment of continued fevers, especially typhoid, as there are equally effectual means of combating fever that are free from the depressing qualities of coal-tar derivatives. The antitoxins, except that of diphtheria, are dismissed with only a casual mention. The value of diphtheria antitoxin is, of course, distinctly recognized, and accurate dosage, according to age, is given. This, as well as the treatment of animal gland extracts, of which thyroid extract and the suprarenal gland preparations are favorably mentioned, represents the present status of the question of serum and animal therapy, and is in accord with general clinical experience.

In the portion of the book devoted to prescription-writing, the claims of the metric system to be admitted to general practice are fully recognized, and we cordially join with the author in the hope that the adoption of the system by the Pharmacopœia may lead to its adoption by the profession generally. As long as we continue to think in the old system, some method of transposition will be indispensable, and the one suggested by the author is as convenient as any. In writing ordinary prescriptions, which do not demand absolute accuracy of dosage, it will save time and trouble to bear in mind that the number of teaspoonful doses

in a 2-ounce mixture is equal to the number of grains—approximately 16—in a gramme; it is, therefore, only necessary to write opposite the name of the ingredient the number representing the desired dose in grains or minims, since it will represent the number of grammes or cubic centimetres required for the whole mixture. If the mixture is to be three ounces—100 cubic centimetres—the numbers are multiplied by 1½; if the dose is to be two teaspoonfuls, the numbers are divided by 2, etc., according to the amount of the mixture and of the dose desired. For drugs that are prescribed in fractional doses, the equation 1 grain equals 0.06 gramme must be carried in the mind.

The short abstract of dietetics, which should properly be regarded as an integral part of therapeutics, is a valuable addition to the book. A table of doses, a list of the important poisons and their antidotes, with other tabular matter, and two complete indices, one "general" and one "therapeutical," complete the volume, which, as regards arrangement, type, and other details relating to book-making, is a good example of the up-to-date text-book. R. M. G.

A Compend of Human Physiology. By Albert P. Brubaker, M.D. Eleventh edition. Philadelphia: P. Blakiston's Son & Co.

Another edition, the eleventh, bears witness to the popularity of this quiz-compend of physiology, which is too well known to the student world to require a formal introduction. It is not compiled on the question and answer plan, and therefore discourages the objectionable plan of learning by heart, which is the immediate result of using many of the so-called aids to students. The book is cordially recommended to students for whom it is intended, and it will no doubt be consulted by older men as well in looking up a question of physiology after the store of college information has grown rusty. The text is diversified with some excellent illustrations and numerous tables. The index is not much more than nominal, and were it not for the excellent arrangement of the subject-matter and the abundance of headings that catch the eye one might be disposed to grumble at the author's parsimony in that respect. R. M. G.

A Text-book of Surgical Principles and Surgical Diseases of the Face, Mouth, and Jaws, for Dental Students. By H. Horace Grant, A.M., M.D., Professor of Surgery and of Clinical Surgery in Hospital College of Medicine; Professor of Oral Surgery in the Louisville College of Dentistry, etc. Philadelphia and London: W. B. Saunders & Co., 1902.

It is of prime importance that a dentist should understand something of the principles underlying general surgical practice and that he be able to properly interpret the initial symptoms of certain conditions which may first come to his notice. We refer to such diseases as chancre, cancer of the tongue, cancrum oris, fibroid growths of the jaws, etc.

And, again, this knowledge must be called into play in the treatment of those conditions where the general surgeon and the dentist are associated. The book before us is written by a general surgeon for the instruction of dental students. It presents in simple language exactly what a dentist should know about surgery in general, such as inflammation and its results, anæsthesia, hemorrhage, tumors, etc. The presentation of these subjects is much after the style of that found in the smaller works on general surgery.

One criticism we have to offer is that the discussion of cleft palate occupies but three pages and is illustrated by only three cuts. This would certainly seem to be a surgical condition about which dentists should be well informed. Much has lately been written upon the treatment of cleft palate, particularly by the English surgeons, and yet little reference is made to what has been accomplished by the recent methods of treatment. The illustrations of the book are especially good. We regret to see that under the head of neuralgia the author has not warned the dental student against the removal of teeth for the relief of trifacial neuralgia. We feel that such advice is necessary, since so frequently cases of tic douloureux involving the second and third divisions of the nerve come to the surgeon with a number of all the teeth on the affected side extracted. Dentists should be made to understand that the extraction of teeth never relieves the condition, although the pain may be referred to them. J. H. G.

A Manual of Medical Treatment or Clinical Therapeutics. By J. Burney Yeo., M.D. Chicago: W. T. Keener & Co., 1902.

The tenth edition of this work is issued in two conveniently sized volumes, comprising more than fourteen hundred pages. The material is arranged in an interesting and thoroughly practical way. Wherever it has been possible in the consideration of a disease, the mode of causation, the morbid changes, and the probable manner in which the remedial agencies influence its course have been set forth. Thus the reader is enabled not only to learn the treatment of diseased conditions, but also to get a fairly comprehensive grasp of other important facts found usually only in books on practice. The work will be found satisfactory. T. A. C.

A Text-book of Pathology and Pathological Anatomy. By Dr. Hans Schmaus. Translated from the sixth German edition by A. E. Thayer, M.D., and edited with additions by James Ewing, M.D. Illustrated with 351 engravings, including 35 colored insert plates. Philadelphia and New York: Lea Brothers & Co., 1902.

Dr. Ewing in his edition of Dr. Schmaus' text-book of *Pathology* has contrived to arrange a book adapted especially for the need of students. It is by no means a book of reference, and all discussions and bibliography are carefully omitted. Indeed, the total lack of

quotation of authorities is noticeable, and seems not altogether satisfactory. The book is divided into two parts, the first dealing with general pathology, in which are included chapters on disorders of circulation and regressive and progressive processes; while the second part is devoted to the subject of special pathology, in which the various systems of organs are treated in order. The fundamental principles of inflammation, tissue repair, and regressive changes are fully described, and the subject of tumors is well dealt with. A very short account is given of the more important parasites. In the special pathology the main changes affecting the different organs are recounted, and frequently clinical data are also added. The details of histological change are often subordinated to a general survey of the disease, and no attempt is made to set forth the nicer problems of cellular pathology or to introduce the results of researches so recent that they would necessitate discussions. The diseases of the nervous system are treated of quite fully and adequately. Numerous illustrations are used to elucidate the text.

W. T. L.

A Manual of Materia Medica and Pharmacology. By David M. R. Culbreth, Ph.G., M.D., Professor of Botany, Materia Medica, and Pharmacognosy in the Maryland College of Pharmacy; Professor of Materia Medica and Pharmacognosy in the University of Maryland Medical and Dental Schools. Third edition, enlarged and thoroughly revised. Pp. 916. Philadelphia and New York: Lea Brothers & Co., 1903.

The third edition of this work comes to us offering ample evidence of enlargement and thorough revision, to be found in each portion of the book. The author's desire for increased accuracy in the old and intelligent discrimination in the selection of materials for the new has reached satisfaction. While the previous editions were worthy of and received commendation, the present must command more; the author, incited by the success already attained, has renewed his efforts, and the result is especially satisfactory. The first fifty pages are devoted to definitions, forms of medicines, avenues by which they are introduced into and means by which they are transmitted through the system, and the conditions which may modify the action of remedies. The various methods by which medicines may be classified are presented, and the author announces his—that by natural affinities; beginning with the lowest and proceeding to the more highly developed, drugs are grouped together as (1) organic, from the vegetable kingdom; (2) from the animal kingdom; (3) inorganic, from the mineral kingdom; (4) organic carbon compounds; (5) non-pharmacopœial organic carbon compounds. This portion of the work is well and thoroughly done, and in its scope is a full presentation of materia medica. The pharmacology as found in "Properties" and "Uses" is brief and quite sufficient for the student of pharmacy, but the student of medicine will probably regard it as rather a guide to more extensive and necessary works on pharmacology and therapeutics.

Part VI. covers twenty pages devoted to the microscope and its use in materia medica. In the Appendix we find an excellent section devoted to Poisons—Treatment and Antidotes. Of Prescription Writing by the

Physician this may be said—complete presentation demands more space and thoroughness of development than is found here. The miscellaneous tables of weights, measures, doses, drops, thermometers, abbreviations, constituents, pronunciations, are all useful, and, as such, important. We wish, however, that on page 870 the author had stated the capacity of domestic measures as they are more commonly met with rather than those commonly accepted. Amid such general excellence of diction a few expressions become disagreeably noticeable; for example, "*gulp*" (p. 21), and "*children are very acute to opium*" (p. 26). For a systematic treatise upon the materials used in the treatment of disease, to which is added a brief exposition of their properties and uses, the student of pharmacy may turn to Culbreth resting assured that the information which he will obtain will be full and accurate. We congratulate the author upon the completion of his third edition, and feel that this is but the forerunner of many succeeding revisions. R. W. W.

ATLAS AND EPITOME OF DISEASES OF THE MOUTH, PHARYNX, AND NOSE. By DR. L. GRUNWALD, of Munich. Second edition, revised and enlarged. Authorized Translation from the German. Edited with additions by JAMES E. NEWCOMB, M.D. Containing 102 illustrations on 42 lithographic plates, and 41 figures in the text. Philadelphia and London: W. B. Saunders & Co., 1903.

THE uniform excellence of this series of hand atlases is not marred by this number of the series. In former days plates such as those contained within it would have only been got out by the publishers in huge, unwieldy volumes. In this little work all the essential parts of the large plates are produced, and the various illustrations are chosen with so much judgment that the book may be regarded as constituting a complete pictorial guide to diseases of the upper respiratory tract. Under the able editorship of Dr. Newcomb the text of this volume is especially good. He has incorporated some additions which add greatly to the value of the German text; thus, he describes the form of tonsillitis occasioned by the bacillus of Vincent, and also Koplik's spots. The book constitutes an invaluable companion for the specialist and a most reliable guide for the student and practitioner. F. R. P.

ANATOMY AND HISTOLOGY OF THE MOUTH AND TEETH. By I. N. BROWNELL, M.D. Second edition, revised and enlarged. Philadelphia: P. Blakiston's Son & Co., 1902.

THE first edition of Dr. Brownell's book had already won for itself a gratifying position as a most excellent manual of the subjects which it purported to teach. The present edition has given him the opportunity to revise the few small errors which invariably happen in the first appearance of any book, and also to add material of much value to the work. An excellent addition has been made in the chapters pertaining to the embryology of the mouth and anomalies of teeth formation and

structure. The illustrations are numerous and excellent, and the volume is one of the most up-to-date text-books upon the subject of the anatomy of the mouth which has appeared in recent years. D. S. R.

DIE PROTOZOEN ALS PARASITEN UND KRANKHEITSERREGER. Presented from a biological standpoint. By DR. F. DOFLEIN. Pp. 274, with 220 illustrations. Jena: G. Fischer, 1901.

IT is seldom one sees a text-book of this nature in which it is so easy to find just what he wants. The arranging and indexing is perfect. After a brief but comprehensive introduction on protozoa and parasites, the author takes up the protozoan parasites systematically and in detail. The descriptions, though at a time sketchy, are much helped out by the copious illustrations. Some of the illustrations are original—more, however, after the original drawings by those who have given the first descriptions of the organism. In the case of each organism, particular attention is given to its life cycle and the various hosts invaded by it; and, further, there is added a brief statement of lesions and symptoms produced in the host. The text is completed by reference to the original description of such species, a section on technique for each important group, and a bibliography for each class, indicating the more important works on the subject. The book is completed by a table of contents, index of subject-matter, of hosts, of authors, and of illustrations. Though one may not agree with the author as to proper terminology and as to some minor points of interpretation, the book as a whole is one to be recommended to those interested in the parasitic diseases of protozoan origin. C. H. B.

PROGRESSIVE MEDICINE. Vol. III., September, 1902. A Quarterly Digest of Advances, Discoveries, and Improvements in the Medical and Surgical Sciences. Edited by HOBART AMORY HARE, M.D., Professor of Therapeutics and Materia Medica in the Jefferson Medical College of Philadelphia. Octavo, cloth, 421 pages, 26 illustrations. Philadelphia and New York: Lea Brothers & Co.

IN close accord with the high standard of excellence set by preceding numbers, there has appeared the third volume of *Progressive Medicine* of this year. The first part, by W. Ewart, deals with the Diseases of the Thorax and Its Viscera, including the heart, lungs, and blood-vessels; the second, by W. S. Gottheil, with Dermatology and Syphilis; the third, by W. G. Spiller, with the Nervous System; the fourth and last, by R. C. Norris, with Obstetrics. Each of these articles, in addition to containing a résumé of the more important of the recent work upon its respective subjects, is enhanced in value by the embodiment of the notes and comments of the able contributors, whose eminence in their particular branches entitles their opinions to consideration and respect.

The choice of the articles abstracted, as well as the terse and lucid manner in which they are set forth, renders the book of invaluable

service to the practitioner who tries to keep abreast of the vast and voluminous wave of modern medical literature. G. W. N.

THE PRACTICAL MEDICINE SERIES OF YEAR BOOKS. Under the general editorial charge of GUSTAVUS P. HEAD, M.D. Vol. X. Skin and Venereal Diseases; Nervous and Mental Diseases. Edited by W. L. BAUM and HUGH T. PATRICK. Chicago: The Year Book Publishers.

THE rapid growth of knowledge in every department of medicine provides such abundant material for year books and similar publications that the editors of this volume deserve the reader's thanks for keeping it within such moderate limits. The selection of the material attests their excellent judgment as well as their diligence, and while the treatment of the various subjects is necessarily brief, the book is most suggestive, and the abundant bibliographical references incite to further study. Although the book is so compact and the subject-matter judiciously arranged under bold-faced headings, a very full index is also added, which makes the finding of any desired subject the work of only a few minutes. R. M. G.

REGIONAL MINOR SURGERY, DESCRIBING THE TREATMENT OF THOSE CONDITIONS DAILY ENCOUNTERED BY THE GENERAL PRACTITIONER. By GEORGE GRAY VAN SCHAICK, M.D., Attending Surgeon to the French Hospital, New York. New York: The International Journal of Surgery Company.

IT has been the author's aim to present a small book which might act as a guide to the general practitioner in treating certain minor ailments and injuries of a surgical nature. This, we think, he has well done. The opening chapter deals with asepsis, and the reader is impressed with its importance even in the performance of the most trivial surgical operation. The suturing of wounds is carefully described, and an excellent little diagram, which we have never before seen, is given, showing the method of closing a semicircular wound. This is the sort of book which it would be well for every new graduate, whether he is going at once into practice or whether he is to become a hospital resident, to read, as he will find here many minor practical points which the larger text-books do not present.

There are a number of subjects which one might suppose the author would have included in a book of this kind, but, on the whole, we think he has made a wise selection. One omission, however, we can but call attention to, and that is the absence of any chapter dealing with the treatment of fractures of the upper extremity. These fractures are very frequently treated by general practitioners. Great improvements have been made in their treatment during recent years, and we feel that the addition of a chapter or two on this subject would greatly enhance the value of the book. Another criticism we would offer is the fact that the author's description and illustrations of the Gibney adhesive strip dressing for sprains of the ankle is not the Gibney dressing as we

know and practice it. Although before reading this book we would have doubted the desirability of such a work, we now realize the want of it and commend the present volume. J. H. G.

A MANUAL OF DISSECTION AND PRACTICAL ANATOMY. FOUNDED ON GRAY AND GERRISH. By WILLIAM T. ECKLEY, M.D., Professor of Anatomy in the Medical and Dental Department of the University of Illinois, the Chicago School of Anatomy and Physiology, the Chicago Clinical School, and West Side Training School for Nurses, and CORINNE B. ECKLEY, Demonstrator of Anatomy in the Medical and Dental Departments of the University of Illinois and Chicago School of Anatomy and Physiology, and Member of the American Association of Anatomists. Illustrated with 220 engravings, 116 of which are colored. Philadelphia and New York: Lea Brothers & Co., 1903.

THE fact that a new manual of dissection has been offered by the publishers would seem to indicate that there is a need for such a work. The old Dublin *Dissector*, which was so popular with our preceptors, and Heath's *Practical Anatomy*, which was the companion of our student days, will have to give way for the more modern works to be used in the dissecting-room. As announced in the preface, the present work has a twofold purpose, namely, to provide the student with a detailed guide for dissection and to answer the requirements of the physician and the surgeon wishing to review the anatomy of any region. It is prepared for practical use with either *Gray* or *Gerrish*, and a large series of illustrations have been taken from these works and placed at the disposal of the author, thereby greatly enhancing the value of the book. In addition to the usual descriptive matter found in dissectors, the work abounds in tables, and we find, in addition to the usual tables met with, it combines tables of the muscles of expression, tables of the muscles of mastication, and even tables of the branches of the vagus and tables of the cutaneous veins.

The introduction of the new nomenclature into this work has been done judiciously, but the section on metamerism would seem to be out of place in a dissector. The divisions of the abdomen as given in the abdominal topography are after the plan of Gerrish, the upper line being drawn between the tenth costal cartilages instead of between the extremities of the ninth ribs; and while the description gives the line as drawn from the highest level of the iliac crest, the illustration gives it as drawn from the anterior superior iliac spines.

The illustrations are particularly good, and can be used not only as a supplement to the text, but in many cases—as those relative to the brain—they may be used in substitution for the text in making dissections.

The table on the vascular system is greatly enhanced in value by the addition of small outline drawings incorporated into the text.

The work will be found very useful in the dissecting-room, and will also prove valuable to practitioners desiring to rehearse regional anatomy. The publishers of the book are to be complimented upon the very attractive appearance of the volume. J. K. Y.

PROGRESS

OF

MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

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Acute Nephritis following Mumps.—PAGANELLI (*Riv. Crit. d. Clin. Med.*, 1902, vol. iii., 726), from Silvestrini's clinic, reports a case of mumps in a boy, aged nine years, who had never suffered from any of the exanthemata. At first the symptoms were light, the affection being limited to the right side, while at the same time a younger brother had bilateral parotitis. Two days later the patient became very ill: respirations, 44; temperature, 39.4° C; pulse, 120. Slight œdema of the eyelids and of the extremities, especially of the hands and feet. Urine scanty, 0.4 per cent. albumin; in the sediment, numerous hyaline and epithelial casts and a moderate number of red and white blood corpuscles. Stained specimens from urine passed into a sterile vessel showed a moderate number of bacteria, a few bacilli coloring with Gram, but no cocci which held their color with Gram. Cultures showed only a few ordinary bacteria (mesentericus, proteus, sarcinæ, and bacilli of the colon group). One rabbit inoculated with the sediment of the urine died after fifteen days of infection with a variety of the bacillus coli, while the other died after a month, of coccidiosis. After sixteen days the fever fell to normal, the œdema disappeared, the urine cleared up, and the patient rapidly recovered. The relation of this attack to the parotitis, together with the absence of evidence of any other general infection, led the author to believe that the renal process was due to the specific cause of parotitis. While slight albuminuria is not infrequent during the course of parotitis, actual acute nephritis is so unusual as to justify mention of the case.

On the Working Capacity of the Heart.—GALLI (*Münchener med. Wochenschrift*, 1902, Band xlix., pp. 953, 1005, 1049). While the recognition of weakness of the heart muscle is easy enough when recogniz-

able dilatation and subjective symptoms of dyspnœa, etc., have developed, yet it must be said that we have up to the present time possessed no satisfactory means of estimating the muscular capability of the apparently normal heart. Galli in a careful study seeks to show that valuable information concerning this important point may be obtained from a study of the reduplications of the heart sounds, and more particularly of the reduplication of the second sound heard in the pulmonic area. The majority of observers have divided the reduplications of the second sound into the physiological and pathological, regarding as physiological reduplications those occurring in apparently normal individuals which are inconstant and vary with different phases of the respiratory act. The truth of Potain's observation that the so-called physiological reduplication of the second sound is especially marked at the end of inspiration and at the beginning of expiration has been recognized by most observers. Observations as to the frequency of the reduplication, however, have varied greatly. Gerhardt found it 18 times out of 260 individuals, who were, however, for the most part patients, though the majority were not in bed; Potain, 38 times out of 500; while Landgraf in 594 healthy soldiers failed to find a single reduplication. Galli examined carefully 300 individuals—200 apparently healthy individuals, 100 others—patients in the hospital. These were examined frequently at different times of the day and under varying conditions. He made frequent examinations of 120 carabinieri at one of the barracks in Rome. His observations here were most interesting in that he found early in the morning an average of 19 reduplications in every 100 men. In the middle of the day after exercise there were 40; at half-past three in the afternoon 56. Where a reduplication had occurred in the morning it was *never* absent in the afternoon or evening. Reduplication was more frequent in the recumbent posture, in which he examined all his patients; while Landgraf's statistics were based upon examinations made in the erect posture. This he believes may be due to the fact that the left ventricle has more work to do in the erect posture, on account of the increased blood pressure which results in a slight retardation of the second aortic sound—enough to prevent a reduplication from delay in pulmonic closure. The reduplication was constantly found during recovery from infectious diseases.

What conclusions may be drawn from these observations? Dehio, while accepting the division into physiological and pathological reduplications, has stated that, in his opinion, the reduplication of the second sound when present in otherwise healthy individuals is suggestive of weakness of the right heart. Galli inclines strongly to the same opinion, believing, moreover, that the "diastolic reduplication is a valuable symptom of exhaustion of the heart muscle, and gives us, therefore, a measure of the functional capacity of the heart." The right ventricle may be called the *locus minoris resistentiæ* of the heart, and the period of the respiratory act at which this phenomenon is especially perceptible is just that time at which the greatest work is called for. "The right ventricle is . . . during inspiration, but especially at the end of inspiration, much filled with blood, and must, as a result, contract with greater energy in order to empty its contents into the pulmonary vessels—all the more since the elastic pull of the lungs reaches its highest degree at the end of inspiration;" though

it is possible that this is compensated for to a considerable extent by the simultaneous dilatation of the pulmonary vessels. If, however, the right heart be weakened, systole at the end of inspiration will be more difficult, slower, and may well result in a slight delay in the closure of the valves; and the degree of interference with the right heart will depend upon the depth of the inspirations. In cases, then, of very slight weakening of the heart muscle, the pulmonary reduplication may be heard only at the end of inspiration—"a reduplication of the first degree." If the weakness be a little more, the difficulties in the way of contraction of the ventricle may last for a few beats into expiration —"a reduplication of the second degree." Where severe alterations of the cardiac muscle are present we may have a persistent reduplication during all phases of the respiration —a "reduplication of the third degree." Delay in the second aortic sound may also occur, but for different reasons, which the author considers.

According to Galli, then, diastolic reduplication is a symptom of exhaustion of the heart muscle, which may depend upon four causes: (1) Diseases of the heart muscle; (2) elevation of pressure in the pulmonary vessels or the aorta; (3) modifications in the pull exercised by the lungs ("Lungenzug"); (4) nervous causes. The recognition of these facts is a matter of importance because of the value of rest and proper treatment in early cases. His conclusions are as follows:

1. The present division of reduplications into physiological and pathological is not justified, since it does not rest upon clinical facts; they should rather be divided into reduplications of the first, second, and third degree.

2. Diastolic reduplication is always and under all circumstances a pathological phenomenon; that of the third degree is the worst and the least influenced by the rest.

3. Diastolic reduplication is an indication of insufficiency of the heart, and is therefore a good criterion for the estimation of the functional capacity of the heart.

4. It is necessary to separate the pathology of the heart sharply into that of each side, and to distinguish between reduplications due to affections of the right and of the left ventricle.

5. Rest is the best method of treatment for diastolic reduplications and the best method to prevent the development of cardiac insufficiency.

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1. Experiments on the Effects of Freezing and Other Low Temperatures upon the Viability of the Bacillus of Typhoid Fever, with Considerations Regarding Ice as a Vehicle of Infectious Disease. 2. Statistical Studies on the Seasonal Prevalence of Typhoid Fever in Various Countries and its Relation to Seasonal Temperature.—SEDGWICK and WINSLOW (*Memoirs of the American Academy of Arts and Sciences*, vol. xii., No. 5, pp. 472–577) conducted a series of very elaborate experiments on the effects of freezing and other low temperatures on the typhoid bacillus, with the view of determining the degree of risk of typhoid fever being contracted from infected ice. They also endeavor to find an explanation for the autumnal prevalence of typhoid fever by a most elaborate statistical study of the disease in various countries.

The authors first give an exhaustive review of the literature relating to ice

as a vehicle of disease, and to the bacteriology of ice. The work that has been done along this line leads them to the conclusion that about 90 per cent. of ordinary water bacteria are eliminated by the process of freezing. They found that the work that had been done on the percentage reduction of the specific pathogenes, and in particular of the typhoid bacillus, the most important one, was very meagre. The only experiments that dwelt quantitatively with the effect of cold on this organism were four in number: three by Prudden, and one by the biologists of the Massachusetts State Board of Health. They considered this to be meagre evidence on which to base conclusions as to the importance of ice supply as a possible source of typhoid fever, and proceeded to supplement this evidence by a careful series of bacteriological studies.

It is impossible to give here even a brief account of how these were carried out. It suffices to say that they were most painstaking and thorough. They found that about 50 per cent. of the typhoid bacilli were killed during the first half-hour of freezing. Less than 1 per cent. of typhoid germs in water survive fourteen days of freezing. Thawing and refreezing are somewhat more fatal than simple freezing. Four successive freezings and thawings do not, however, suffice to kill off the most resistant bacilli. Typhoid bacilli behave in water just above the freezing point much as they do in ice. A large proportion are killed by a few minutes' exposure. In the next few hours the reduction proceeds *pari passu* with the duration, while a few germs persist for some time. Ice formed on the surface of a quiet body of water contains only about 10 per cent. of the bacteria contained in the water just below. This difference is believed to be due to physical exclusion by the process of crystallization and not to any germicidal action.

From these results and from other evidence the writers bring forward they conclude that the risk of contracting typhoid from the use of natural ice is infinitesimally small. The risk is greater, however, with artificial ice if the water is not perfectly pure. Epidemiology has clearly shown that disease follows best a direct, quick transfer of infectious material from patient to susceptible victim; and inasmuch as artificial ice is used quickly after its manufacture, the possibility of purification by time is excluded, and such ice might therefore be a menace to public health.

Although certain writers have claimed that typhoid is not more frequent at any particular season of the year, yet the concensus of opinion is strongly in support of the view that typhoid fever the world over is much more frequent during the fall months. While in this latitude these months are September, October, and November, they are not the same everywhere, the seasons varying according to longitude and certain physical conditions.

Sedgwick and Winslow proceed to find some explanation for the autumnal prevalence of typhoid fever. After an exhaustive review of the literature on the subject they come to the conclusion that none of the explanations advanced, including the ground-water theory of Pettenkofer and the Munich School, adequately account for this seasonal relationship. They give credit to Murchison, Liebermeister, Davidson, and Woodhead for having pointed out an association between the high temperatures of summer and the prevalence of typhoid in the fall. The reason for this had never been explained, and their views never gained general acceptance.

The writers thought that their bacteriological work on the effect of low temperatures upon the typhoid bacillus supported the idea that the temperature really might in itself exercise a direct effect upon the etiology of the disease. They hoped to be able to prove this by the study of statistics gathered from a wide field. Accordingly they brought together statistics of the monthly variations in temperature and in the prevalence of typhoid fever for thirty large cities or communities scattered over the whole world. Four continents and both hemispheres were represented. The temperature and typhoid statistics were tabulated for each place for a number of years—usually ten. They plotted curves representing the mean monthly temperatures and typhoid cases or deaths for these periods for each community. In twenty-one of the communities the curves were almost identical, the only difference being that the apex of the temperature curve was at its height just two months before that of the typhoid curve, so that by shifting the typhoid curve just two months ahead the two curves were found to be practically identical. The temperature curve was highest about August 1st, and the typhoid curve highest about two months later. The failure of the curve to present itself in the nine other communities was explained by the investigators by local conditions, so that in their opinion these instances did not diminish the importance of the evidence in the twenty-one districts.

The writers think that the increase of typhoid fever with a gradual rise in the mean air temperature of a given locality is a phenomenon so widespread that it indicates beyond reasonable doubt some relation between the two factors.

Of the three great intermediaries of typhoid transmission—fingers, food, and flies—they hold the last to be the most important. The relation of this factor to the season is close and complete, and they claim that a certain amount of the autumnal excess of typhoid is undoubtedly traceable to the presence of large numbers of flies. They hold, however, that none of the usual factors cited, including the activity of flies and the exposure of urban subjects to rural unsanitary conditions, can explain the autumnal prevalence of typhoid and its close relationship with high summer temperatures. They believe that their experiments lead them to reasonably suppose that it must be more difficult for the typhoid organism habituated to a temperature of 98° F. to persist in nature when the thermometer is at 30° than when it is in the neighborhood of 80°. They assert that it is the absence of the destructive influence of cold rather than any stimulating influence of heat which permits the rise culminating in the autumnal maximum.

The typhoid organisms are carried over the winter in the bodies of a few patients, or possibly in vaults, or in other deposits of organic matter, where they are protected from the severities of the winter. The number of persons who contract the disease from these winter cases will depend upon the length of time that the organisms remain alive and virulent. The length of the period during which the microbes live will depend largely on the general temperature. As the season grows milder, more and more of each crop of germs sent at random into the outer world will survive long enough to gain entry into a human being. The process will be cumulative. Each case will cause more secondary cases; and each of the latter will have a still more extensive opportunity for causing infection. The warm temperature of the

late summer favors the development of the organism, causing more numerous infections, which manifest themselves in the fall. As winter approaches the organism finds less favorable temperature environment, and the cases gradually diminish again.

THERAPEUTICS

UNDER THE CHARGE OF

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A New System of Treating Pulmonary Phthisis.—DR. DUNCAN TURNER speaks of the improvement taking place on the old line of treating patients in sanatoria when he introduced the use of electricity (cataphoresis), massage and the rubbing of cod-liver oil. The oil-massage is made daily. The patient, after being hardened by repeated cold sponging for two or three days, lies on a couch naked. His body is then sponged with a weak solution of sodium bicarbonate, one drachm to the pint. The oil mixture is then rubbed in all over the trunk from the neck to the pelvis, back and front, the quantity used at one time being from one to two tablespoonfuls. It should be rubbed in vigorously. When galvanism is used generally one pole is applied over the solar plexus and the other is moved up and down over the upper part of the spine.—*The Lancet*, 1902, No. 4129, p. 1047.

Methylene Blue and Quinine in Malaria.—DRS. JOHN T. MOORE and W. L. ALLISON made an extensive series of studies on these two drugs in their effect in the malarial organism. They conclude that: 1. Methylene blue is probably most valuable in chronic cases, but has no advantage over quinine. 2. Methylene blue will destroy malarial parasites in many cases, but is less certain than quinine. 3. The effects of methylene blue are ordinarily more unpleasant than quinine. 4. It is useful for patients who cannot take quinine on account of some idiosyncrasy to it. Its use in cases of pregnancy is undetermined. 5. It is probably valuable in treating hæmaturic and hæmoglobinuric fevers on account of its diuretic action; this has yet to be determined. They had no opportunity to test its use in such cases. 6. They believe that quinine is quicker and much more certain, and would rely upon it rather than upon methylene blue.—*Medical News*, 1902, vol. lxxxi. p. 1063.

Pure Urea and Pulmonary Tuberculosis.—DR. VERE PEARSON reports on his experiments with pure synthetized urea in the treatment of pulmonary tuberculosis, and basing his results upon a comparison of the progress made

by his patients, with the average progress made by similar patients in the Brompton Hospital, he shows that of 100 patients over twelve years of age —75 males, 25 females—nine died, seventeen lost weight, seven remained stationary, and the rest gained in weight from one and one-half pounds to twenty-three pounds. Among those who gained in weight the majority showed improvement in physical signs as well as in general condition. In the great majority the temperature and the pulse improved as well, and the expectoration diminished. Urea seemed to exert no special influence upon either the pulse or the temperature, and in no case was there any marked diminution in the quantity, or any appreciable improvement in the quality of the sputum. The conclusions arrived at, the author says, do not, of course, exclude the possibility that urea acts beneficially in cases of tuberculosis other than pulmonary, such, for example, as glandular tuberculosis and lupus, but so far as it was possible for him to judge from the results obtained in his cases he does not believe that there is any special action exerted by pure urea.—*The Lancet*, 1902, No. 4134, p. 1383.

Sodium and Potassium Iodides and Their Clinical Use.—Dr. R. B. Wild gives an elaborate study of the comparative value of these iodides. Clinically potassium iodide is claimed to be more active, but is also more liable to cause iodism. He discusses in great detail three factors that are concerned in the action of these iodides: 1. The salt action. 2. The "ion" action of dissociation of the molecule into two moieties which become charged with negative and positive electricity. 3. The supposition that the alkaline iodides are decomposed in the tissues, setting free nascent iodine. Apart from theoretical consideration, the author thinks that the potassium salt is to be preferred, owing to its extreme solubility and rapid diffusive power favoring its penetration to all tissues. Its power of dilating bloodvessels is of great importance, by bringing more blood to the tissues, thus stimulating nutrition and bringing more of the drug to the tissues. As regards two common objections, namely, the liability to iodism and the depressing effect of the potassium, Wild holds that there is little difference between the sodium and the potassium in small doses, but the vascular dilatation of potassium iodide may predispose to catarrhal inflammations and cutaneous eruptions. As for the depressing effects, this is much exaggerated, and to a considerable extent can be further avoided by modifying the diet so as to diminish the amount of potassium salts. Thus potatoes and legumes should be forbidden, and green vegetables are only to be taken in small quantities; but milk, fish, eggs, and the animal foods are to be freely allowed.—*Medical Chronicle*, 1902, vol. xxxvi. p. 285.

Morphine Addiction and Its Treatment.—Dr. C. B. Burr reports a series of twenty cases of this addiction, giving some very interesting and out of the ordinary deductions, the which are nearer actual conditions than many of the cut-and-dried text-book opinions. With reference to the withdrawal of morphine he favors its rapid withdrawal—*i. e.*, within a week to ten days. In some patients a shorter time even may be considered—two to three days—and thus far he has not seen any evil results from the abrupt withdrawal method, although it should be a primary canon that patients

should be handled according to their individuality rather than because of their being morphine *habitués*. In general, on admission to the sanitarium the patients receive a hot Russian bath, and following this the morphine is rapidly withdrawn, strychnine, quinine, kola, coca, champagne, and aromatic spirit of ammonia are given at night. In prescribing chloral the author advises its combination with quinine or strychnine, and at the height of the constitutional disturbance, which he finds to be, as a rule, about the third day following the withdrawal of the drug, he advises the use of ¼ to ½ grain of morphine hypodermically; this rests the body and brings about a relief from the nervous tension and does not interfere with the progress of the treatment.—*Journal of the American Medical Association*, 1902, vol. xxxix. p. 1558.

Two New Drugs: Hopogan and Extogan.—Dr. D. M. Frenkel describes two new drugs—magnesium peroxide, called hopogan, and zinc peroxide, called extogan—both prepared in a pure state. Hopogan is a white, light, tasteless and odorless powder, almost insoluble in water. The filtered emulsion gives a liquid with a slight alkaline reaction, containing small traces of chloride of sodium. The product is composed qualitatively of magnesium and oxygen. It contains 7.15 per cent. of active oxygen, which corresponds to 25 per cent. of magnesium peroxide. Extogan is a light, slightly yellowish, tasteless, odorless powder. It is absolutely insoluble in water. It contains traces of sodium chloride. Its qualitative composition is zinc and oxygen. It contains 9.08 per cent. of active oxygen, corresponding to 55 per cent. of zinc peroxide. Although no clinical work has yet been done upon these drugs, it is believed that they will interest experimenters. Zinc peroxide (extogan), intended for internal use, contains in a latent state, so to speak, oxygenated water. The physician can convert it into its active state on the wound or diseased epidermis, and can regulate its quantitative production. To produce this oxygenated water, tartaric acid would seem to be the best agent. Three parts of zinc peroxide and four parts of tartaric acid will produce oxygenated water at 100 per cent. Clinical experience ought to show that active oxygenated water thus locally generated should have a much stronger bactericidal and cicatrizing effect than ordinary oxygenated water. Magnesium peroxide (hopogan) is intended for internal use; the maximum dose is yet to be determined clinically, but it is thought that one and one-half grammes of pure magnesium peroxide or six and one-half grammes of hopogan in the scale of 25 per cent. of peroxide would present no danger. Once in the stomach, magnesium peroxide is decomposed by the normal or abnormal gastric juice and the oxygen liberated, which, in the case of abnormal condition, probably attacks the products of butyric acid fermentation. However this may be, it must be remembered that the decomposition of magnesium peroxide in the stomach is always accomplished by an appreciable local rise of temperature. The practical value of these drugs is still to be determined by laboratory and clinical experiment. It should be mentioned that the iodides, under the action of magnesium peroxide, give forth iodine, which will make it possible as in no other way to produce iodine in the nascent stage in a quantity that can be exactly calculated in advance.—*Le Progrès Médical*, 1903, vol. xvii. p. 19.

A Study of Tuberculin.—Dr. F. M. Pottenger, in reviewing the status of knowledge concerning tuberculosis when Koch made his discovery, makes the distinction that tuberculin was claimed by Koch to be a cure in early cases of tuberculosis, not in consumption. Along this line he has made a study of tuberculin and allied products, with reference to their action and the proper method of administration. He states that the sanitarium is the ideal place for treating patients by culture products, and that the physician who would use them successfully in general practice must be not only a great, good, general practitioner, but have a thorough knowledge of the pathology, diagnosis, and clinical course of tuberculosis, and understand the proper application of the remedy. He suggests that the patient about to be treated by culture products should be under careful supervision for two days, with a two-hour temperature chart. Suitable places for giving the injection are the loose tissue between the scapulæ, over the chest, below the clavicles, and in the belly of the triceps. The effects produced depend on the amount of dosage, being slight in small doses, and showing three or four degrees of temperature in large doses. There may be weakness, aching, and nausea, and a severe local reaction. The remedies, by stimulating the tissue, cause resolution to hasten, and also produce immunity. Though chiefly of value in early stages, they benefit areas of recent extension that are purely tuberculous in advanced cases. Old tuberculin (Koch) is seldom used, but when it is the initial dose should be small, one one-hundredth to one-tenth of a milligramme. The new tuberculin T. R. (Koch) has for an initial dose one one-thousandth to one five-hundredth milligramme, injections to be repeated every day at first, doubling the preceding dose till one-tenth of a milligramme is reached. Purified tuberculin (von Ruck) has for the initial dose one-tenth of a cubic centimetre, to be increased every other day by one-tenth of a cubic centimetre until five-tenths of a cubic centimetre is given. Watery extract of tubercle bacilli (von Ruck) have the advantage over T. R. of being stable. The administration is begun by using one-tenth of a cubic centimetre and increased according to susceptibility as in the other products. A slight rise of temperature during administration is not to be disregarded. If there are infiltrations in the larynx the local reaction, which, detected upon laryngoscopic examination, serves as an excellent guide to dosage. A distinctive feature that makes the rise of temperature caused by the remedy is that the elevation stops on its withdrawal. The author finds that by using culture products in addition to the nutritious food, fresh air, rest, exercise, and hydrotherapeutic measures, 20 per cent. more patients are cured than when these remedies are admitted.—*Therapeutic Gazette*, 1903, vol. xxvii. p. 12.

Hyoscine for the Morphine Disease.—Dr. R. C. Rosenberger reports an interesting history of a confirmed taker of morphine. The patient during eleven years had used the drug, and his regular dosage was from 30 to 60 grains a day. The immediate urgency for treatment was an acute maniacal attack. The morphine was withdrawn and $\frac{1}{100}$ grain doses of hyoscine hydrobromate administered every hour. After twenty-five days the patient made a complete recovery, and has remained free from the use of the drug for eleven months.—*Medical News*, 1902, vol. lxxxi. p. 1013.

OBSTETRICS.

UNDER THE CHARGE OF

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Hydatid Mole.—In the *Journal of Obstetrics of the British Empire*, November, 1902, HART contributes an interesting paper upon this subject. He considers, first, the structure of the early normal villus, and draws attention to the relative position of Langhan's layer and of the syncytium, and also Nitabuch's fibrin layer. He believes that both the layers covering the villus are fœtal and ectodermic in origin. He calls attention to the fact that the syncytium and Langhan's layer have no coagulating action on the blood. He believes that normally the early villus has this double epithelial covering, Langhan's layer, and syncytium. These can absorb decidual tissue by penetration, and can pass into bloodvessels without coagulating the blood. Normally their progress is limited by the fibrin layer known as Nitabuch's fibrin layer. The epithelial mantle and connective tissue core, which approximates Wharton's jelly in structure, differentiate in the normal placenta, the syncytium thinning and Langhan's layer flattening, while the connective tissue becomes more fibrous. He estimates that hydatid mole is rare and that in microscopic structure the most notable condition found is the change in the epithelial covering.

The clinical features of hydatid mole consist in the watery or blood-tinged discharge, the enlarged uterus with discharge of vesicles, and the uterine tumor unfixed. Hydatid mole is rarely found in the tube or in the paravaginal tissue.

Hart estimates that in about one-half of recorded cases of syncytioma malignum hydatid mole has preceded the malignant growth. He does not believe that in ordinary cases microscopic examination of a given specimen can determine whether a mole will be followed by deciduoma malignum or not. He is, however, in favor of curetting patients who have had hydatid mole and in whom the uterus remains enlarged, and of carefully examining the scrapings. Should suspicious tissue be found, it will be safer to remove the uterus.

The Fœtal and Maternal Blood Serum.—HALBAN and LANDSTEINER have made a series of experiments upon the serum of maternal and fœtal blood in the Anatomical Institute at Vienna. Their conclusions are as follows: There is a marked difference in the reaction of maternal and fœtal blood in several respects. The serum of the mother's blood requires a larger number of corpuscles to undergo solution than does that of the fœtus. The serum of the mother's blood agglutinates blood corpuscles much more

actively than does that of the fœtus. It has also a stronger action against bacteria and against the process of fermentation. It is also more potent as an antitoxin, and is a more potent agent as an immunizing serum. The active principles of blood serum seem to be present in the blood of the fœtus, but not to be well developed nor to be active. The deficient development of blood serum in the newborn explains the susceptibility of infants to infection. It would be of interest and practical importance to ascertain at what period of extra-uterine life infantile serum becomes active, and how such a result could be brought about.

Intraperitoneal Hemorrhage and Ectopic Gestation.—In the *Journal of Obstetrics of the British Empire*, November, 1902, CULLINGWORTH publishes his lecture upon this subject. The purpose of his lecture is to call attention to the essential points of diagnosis in these cases.

He first describes the symptoms in a case of intraperitoneal hemorrhage following the rupture of an ectopic gestation. He considers the following diagnostic points in these cases as of especial value:

1. The fact that at the moment of attack the patient was in her usual health. This renders it improbable that the hemorrhage was the result of previous chronic disease.

2. Gradually increasing pallor of the patient and the gradually rising pulse rate without rise of temperature.

3. The extreme tenderness of the abdomen.

4. Evidence of derangement of menstruation. For such a condition he believes immediate operation imperative.

In considering pelvic hematocele he believes the majority of cases due to ruptured ectopic gestation. Irregular hemorrhages and pain are almost equally constant symptoms. The appearances of decidua in the vaginal discharges may escape observation. Faintness, nausea and vomiting, rise of temperature, and retention of urine are less constant symptoms of secondary importance. As regards the physical signs of hematocele, an irregular, tender, fixed swelling behind the uterus, pushing that organ forward and to one side, is the condition usually present. The tumor bulges into the rectum and extends laterally into one or other of the pelvic fossæ. When much blood is effused the swelling may reach upward into the abdomen, often higher than the fundus uteri, and sometimes nearly to the umbilicus. At first the outline of the swelling is difficult to make out, owing to the general abdominal distention, the rigidity of the muscles, and great tenderness. In a few days these conditions are altered and the parts are more relaxed. The uterus is usually a little enlarged, displaced forward, and adherent posteriorly. Irregular hardness is felt in the tumor, caused by the adherent pelvic viscera. At times Douglas' cul-de-sac is empty, and the swelling is entirely at the sides.

Pelvic hematocele must be distinguished from retroversion of the gravid uterus, ordinary abortion, inflammation of the uterine appendages, with or without a new growth, or an unsuspected ovarian cyst, with sudden twisting of the pedicle. It may be differentiated from a retroverted uterus by the consistence and by the rhythmic contractions of the pregnant uterus. It is evident that an effort to replace a hematocele under the supposition that

it is a retroverted pregnant uterus may result in its rupture and in fresh and extensive hemorrhage.

In distinguishing pelvic hematocele from ordinary abortion there is with ordinary abortion very free hemorrhage and the passage of clots, while with ectopic gestation and hematocele there is seldom much bleeding, and clots are not discharged.

All physicians of wide experience have met cases in which it was absolutely impossible to clearly distinguish between ruptured ectopic gestation and hematocele or inflammatory disease of the uterine appendages. Fortunately a condition sufficiently severe to justify abdominal section in either case should be dealt with by section, and so there can be no reasonable doubt regarding the best course of treatment.

These remarks apply to torsion of the pedicle in ovarian cyst which had not been diagnosed. In any obscure condition in which the symptoms indicate a grave lesion, abdominal section is safer than continued uncertainty, with possibly concealed hemorrhage.

In discussing how it is that the ectopic ovum causes hemorrhage, Cullingworth calls attention to our modern knowledge regarding the embedding of the ovum, which explains the tendency to perforation of the tube and to a continuation of the hemorrhage unless the tube be removed.

GYNECOLOGY.

UNDER THE CHARGE OF

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ASSISTED BY

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Surgical Treatment of Parametric Cicatrices.—OTT (*Journ. akusch. i shensk. Colesnej.; Centralblatt fur Gynäkologie*, 1902, No. 32) while believing that pelvic massage is the best treatment for old indurations in the broad ligaments, has found that some cases are only relieved by operation. The object aimed at should be the complete division of all cicatricial bands, with suture of the wound in the direction opposite to its long axis, in order to prevent subsequent contraction. The greatest care is necessary while working in the broad ligaments in order to avoid injury to the vessels and ureters. It may be necessary to catheterize the latter as a preliminary step.

The writer has usually obtained union by first intention, but when the wounds heal by granulation, as shown by the persistence of the cicatricial bands, early massage is indicated.

Results of Myomectomy and Castration.—SAUER in his inaugural dissertation (*Centralblatt fur Gynäkologie*, 1902, No. 34) analyzes 104 cases, including 62 abdominal sections, 21 vaginal hysterectomies, and 21 castrations

for fibroids. Supravaginal amputation was performed in all but one of the laparotomies. All the cases of myomectomy and hysteromyomectomy were followed by satisfactory results. As a rule, the tumor diminished in size after removal of the ovaries. Climacteric disturbances were rare after total extirpation of the uterus, whether the adnexæ were left or not. They were common after castration and supravaginal amputation. No psychical disturbances were noted.

The Relation of Dyspepsia to Pelvic Disease.—SOMMER (*Centralblatt für Innere Medicin*, 1902, No. 2) made a careful study of twenty-three cases of functional stomach trouble, with a view to deciding the question of their reflex origin. General relaxation of the abdominal viscera and uterine displacements were commonly present. Hyperchlorhydria was most frequently noted. In only two cases was improvement in the pelvic condition followed by relief of the gastric symptoms. In one instance, on the contrary, replacement of a retroverted uterus increased the dyspepsia. In conclusion, the writer states that no connection could be traced between the pelvic trouble and the secretory disturbances.

Sounding of the Tubes.—AHLFELD (*Centralblatt für Gynäkologie*, 1902, No. 41) reaffirms his opinion that in certain cases in which the sound appears to have perforated the uterine wall it is really introduced into a Fallopian tube. He adds the following case to five others previously reported: A nullipara, aged twenty years, had a movable retroflexion. A sound was introduced, two and four-fifth inches, until it touched the fundus uteri. On turning the point toward the left corner it slipped in one and one-fifth inches farther without meeting any resistance. The same phenomenon was carefully noted later with the patient under anæsthesia. Three weeks after ventrofixation was performed, when the tube was found to be of normal calibre and no evidence of any old or recent lesion of the uterus could be found, hence there could have been no perforation.

Lymphosarcoma of the Uterus.—WAGNER (*Centralblatt für Gynäkologie*, 1903, No. 43) reports a case of this rare uterine neoplasm removed by autopsy from a woman, aged sixty-two years. The entire uterus, tubes, parametria, and pelvic and inguinal glands were involved. According to Kundrat, who examined the specimen, the disease must have begun in the lymphoid tissue of the endometrium and extended to the muscular layers. The fact that only three cases of lymphosarcoma of the uterus have been described, is explained by the fact that pre-existing lymphoid tissue is rarely developed in this organ.

This form of neoplasm does not show the same tendency to retrograde metamorphosis and suppuration as cancer. It is beyond the reach of surgery.

Profuse Hemorrhage from a Ruptured Ovisac.—GOTTSCHALK (*Centralblatt für Gynäkologie*, 1903, No. 49) reports a case of intraperitoneal hemorrhage in which he removed from the abdominal cavity a clot, in the centre of which was an ovum the size of a pea, with typical chorionic villi and two

normal fimbriæ. A ruptured Graffian follicle was found surrounded by enormously dilated bloodvessels, the same as those at a placental site. No villi were found in the follicle. It was evident that there was an active hyperæmia and vascular dilatation in the neighborhood of the ruptured follicle. The corresponding Fallopian tube was normal, except that the two fimbriæ found in the clot were missing. According to the writer, as well as in the opinion of his colleagues, the case was one of true ovarian pregnancy.

Extirpation of the Uterus and Vagina for Procidentia.—MIRANDA (*Arch. di Ost. e Gin.; Centralblatt für Gynäkologie*, 1903, No. 49) adds the following case to twelve already reported by different operators: The patient, aged sixty-three years, had had complete procidentia for twenty years. A circular incision was carried around the vulva and two vaginal flaps were formed by making vertical incisions anteriorly and posteriorly. The cul-de-sac of Douglas was opened and the peritoneum was sutured to the edge of the skin. The bladder was then separated, the uterus removed, and the peritoneal opening was closed. The patient made a good recovery.

Pruritus Vulvæ.—SEELIGMANN (*Deutsche med. Wochenschrift*, 1902, No. 9) believes that he has found the cause of this affection (excluding cases due to acid secretions, diabetes, masturbation, etc.) in the shape of a diplococcus resembling the gonococcus in shape and appearance. His treatment consists in applications of guaiacol vasogen in 10 per cent. solution, which may be increased to 15 or 20 per cent. It is applied in compresses at bedtime for several nights, and seldom fails to give relief. If there is a return of the itching one or two applications seldom fail to effect a cure.

Urethral Caruncles.—LANGE (*Zeitschrift für Geb. u. Gyn.*, Band xlviii., Heft 1) examined 1000 patients with especial reference to the presence of so-called urethral caruncle, and found only 58 undoubted cases, in all of which the growth was excised and examined microscopically. In 20 cases the tumor was a telangiectatic mucous polypus, in 19 granuloma, and in 19 papillary polypus. The term angioma is incorrect as applied to caruncle. The etiology is obscure, though gonorrhœa is undoubtedly a cause of granuloma, and gaping of the meatus in old women may sometimes account for the development of papillary mucous polypi.

These caruncles contain numerous glands, and are distinguished microscopically from prolapse of the urethra by the absence of columnar and transitional epithelium on their surface. By themselves caruncles are painless, the pain accompanying them being due to chronic urethritis, prolapse, or insertion of the pedicle high up in the urethra.

Atrophy of the Uterine Mucosa.—VOLK (*Centralblatt für Gynäkologie*, 1902, No. 51) reports the case of a young married woman whose menstruation began at seventeen and continued to be scanty and irregular, but painless, until her marriage, at twenty-two. She was first examined in September, her last period being in February, when she was told that she was four months pregnant, and the diagnosis of pregnancy was confirmed by another physician two months later, though fœtal movements and heart

sounds were absent. Later the diagnosis of uterine fibroid was made, and the tumor (an interstitial growth) was removed, and an examination of the enlarged uterine cavity showed that it was entirely devoid of mucous membrane. Under the microscope the mucosa appeared to have been replaced by loose connective tissue infiltrated with round cells. Near the surface of this cell were isolated cells of an epithelioid type, with indistinct outlines and protoplasm, which took a faint stain with eosin. There was no trace of true epithelium or glands. The muscular layers were unchanged. The ovaries contained numerous dilated lymph spaces lined with endothelium, a few follicles, and numerous corpora fibrosa.

The condition of the mucosa accounted, in the writer's opinion, for the absence of bleeding. The atrophy might be explained by the stretching of the endometrium due to rapid growth of the tumor, as there was no evidence of any inflammatory process. The persistence of ovulation without accompanying menstruation or menstrual molimena was interesting. The fact that the patient had scarlet fever in childhood may account for the beginning of the atrophic process.

Primary Cancer of the Fallopian Tube.—GRAEFE (*Centralblatt für Gynäkologie*, 1902, No. 51) adds the following case to the fifty-two collected by Zangemeister: A nullipara, aged fifty-one years, came to the clinic with a metrorrhagia of six weeks' standing. She complained only of gradual loss of health and vesical tenesmus. The uterus was retroflexed, and a mass, the size of the fist, was felt behind it. She refused operation, and improved under palliative treatment continued for four months. She was then lost sight of from May, 1900, until February, 1902, during which time she was in good health, when she had an attack of abdominal pain with intestinal obstruction. On examination, the tumor previously felt (originally diagnosed as an enlarged tube, possibly malignant) was unchanged, but at the right horn of the uterus was discovered a tumor larger than a child's head. On opening the abdomen an intraligamentary ovarian cystoma was found on the right side, while on the left was a tube the size of the fist, which closely resembled a hydrosalpinx. On section the sac was filled with papillary growths rich in bloodvessels, which were shown microscopically to be malignant. The muscular wall of the tube was invaded, but not perforated at any point.

The writer believes that the papillary carcinoma was undoubtedly present two years and a half before, when he first examined the patient, as shown by the presence of the sanguineous discharge which had then awakened his suspicions, the stoppage of the flow being due to closure of the uterine ostium. The patient was in good health eight months after operation, so that it was fair to infer that no metastases had taken place.

The writer thinks that although, as in the case reported, papillary cancer of the tubes is sometimes relatively benign in character, it is not safe to delay operation on account of the absence of symptoms. Every enlarged tube, not of probably gonorrhœal or infectious origin, which does not diminish considerably in size under palliative treatment, should be removed. The reason why recurrence has been so common after the extirpation of cancerous tubes is doubtless due to delayed operation.

DISEASES OF THE LARYNX AND CONTIGUOUS STRUCTURES.

UNDER THE CHARGE OF

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Saddle-back Nose.—Dr. Joseph A. M. Smurl, of Philadelphia, reports (*American Medicine*, January 31, 1903) and illustrates a case of success in subcutaneous injections of solidifying oils to correct a saddle-back nose. He explains his method in detail as the result of more than four years' experimentation with injections of paraffin.

Primary Nasal Diphtheria.—Dr. Helot, of Rouen, reports (*Annales des Maladies de l'Oreille, du Larynx, du Nez et du Pharynx*, January, 1903) two out of a number of cases of observations of primary nasal diphtheria. He states that the infrequency of this malady is only apparent among cases passing unrecognized in the absence of constitutional symptoms.

Dr. Helot has observed several cases of primary nasal diphtheria without propagation to either larynx or pharynx, the affection in some instances remaining localized in a single nasal passage. Of the two cases reported, one was an example of toxic diphtheritic fibrinous rhinitis, and the other of diphtheritic fibrinous rhinitis without general symptoms. The exact clinical diagnosis, it is stated, cannot be made without bacteriological culture.

Parotiditis.—Dr. Douglas Symmers, of Philadelphia, contributes an illustrated paper (*American Medicine*, January 31, 1903) on the "Chronic Bilateral Parotiditis among the Insane, with a Detailed Account of Five Cases." Each of these cases, it is shown, has several points in common with the others. All were above thirty years of age, and exhibited more or less stigmata of degeneration. Three were almost unquestionably syphilitic, and, with the exception of one case, nephritis had been proved to exist or was strongly suspected. Dr. Symmers refers to Dr. Kyle's opinion that substances in the saliva may be causative of certain enlargements of the thyroid glands, and deems it quite probable that certain cases of syphilis, nephritis, and other morbid conditions are attended by the elaboration of irritant substances in the saliva which bear the selective affinity for the structures of the parotid glands.

Removal of an Accessory Thyroid Tumor at the Base of the Tongue.—Dr. Randolph Winslow, Professor of Surgery in the University of Maryland (*American Medicine*, December 13, 1902), removed a thyroid tumor from the base of the tongue of a girl, aged seventeen years, through an external incision made in the median line from the chin to the hyoid bone, cutting through the mylohyoid muscle and separating the geniohyoid and geniohyoglossi muscles until the base of the tumor was reached, whence it

was enucleated with the aid of an assistant's fingers in the mouth, pressing the tumor down. The covering mucous membrane was removed through the wound with scissors, leaving a large opening communicating with the mouth. This was closed with catgut, as were the separated muscles, and the skin incision was sutured with a subcutaneous silkworm-gut strand. Healing took place by first intention. The growth was about one-half the size of a hen's egg, and its thyroid character was demonstrated by microscopic inspection. Some general remarks and a bibliography conclude the article.

Primary Tuberculosis of the Tongue.—In an illustrated paper on "The Early Appearances, Diagnosis, and Treatment of Tuberculosis of the Upper Air Tract" (*Journal of the American Medical Association*, February 21, 1903), DR. WALTER F. CHAPPELL, of New York, reports a case of presumptive primary tuberculosis of the tongue which preceded by two years any discoverable evidence of pulmonary tuberculosis.

Foreign Bodies (Coins) in the Œsophagus of Infants.—PROF. PIERRE SEBILEAU, of the Hospital Larboisière, contributes (*Annales des Maladies de l'Oreille, du Larynx, du Nez et du Pharynx*, January, 1903) an article on external œsophagotomy in the infant for the extraction of coins in which he emphasizes several points to which we desire to call attention. In most of these cases radiography revealed the positions of the coins transversely impacted at the upper constriction of the œsophagus. In one case out of the five reported, and in which the œsophagus was larger, the coin had passed the first constriction and had become engaged in the thorax in the second constriction, about the level of the bronchial root of the lung. Four of these cases were successfully operated upon. In all of them it was found that the lesions in the œsophagus were confined to the lateral walls which had been subjected to pressure.

In a child, aged three years, in whom a sou-piece had remained for twenty-five days, solid adhesions had become established between the œsophagus and the walls of the primitive carotid artery. These adhesions had occupied the extent of a centimetre, and were a little above the foreign body, which had probably been forced down some two centimetres by contractions of the canal and the force of the alimentary bolus upon the thinned walls at point of impact. The walls of the adhesions were very thin, reduced to a single mucous covering, and confounded with the peri-œsophageal conjunctive tissue.

In a child, aged three years, who had swallowed a five-centime-piece five weeks before the operation, the lesions were identical, but a little less advanced. In a child, aged two years, in whom a five-centime-piece had been in position but ten days, the lateral peri-œsophagitis was still less advanced, but of the same nature. The œsophageal wall was unrecognizable, extraordinarily friable, and enclosed in a sort of reddish, inflammatory mass which extended from the median line to the vessels. Another point made is that skiagraphy should supersede the exploratory procedures with œsophageal probes and extractors. When the operation is not performed immediately after the location of the foreign body a final skiagraphy should be made immediately before the operation. In one instance in which radiog-

raphy revealed the coin in the thorax and in front of the third and fourth dorsal vertebræ, the œsophagotomy was practised the following morning, but it was impossible to find the foreign body, and the wound had to be closed. The child was immediately re-radiographed, and the coin was discovered to have descended into the abdomen.

There are a number of other interesting points in this paper, chiefly of surgical interest.

Falsetto Voice.—A paper on "The Falsetto Voice; Origin and Respiratory Treatment; Dental Irregularities," is contributed by DR. MARCEL NATIER, of Paris, to the February number of *The Laryngoscope*. This has reference to the falsetto or sometimes called eunuchoid voice of male adolescents and adults. Dr. Natier recognizes that the condition is referable to a profound disturbance of the respiratory function, and illustrates his contention by a series of tracings of the respiration during those ordinary phases and during the emission of vocal sounds. He agrees with the majority of observers that respiratory gymnastics constitute the most efficacious and most rapid plan of treatment.

[The collator has for many years found that the habit of speaking in this peculiar voice can be broken by teaching the individual to speak with distended abdomen. This distention of the abdomen forces the diaphragm downward, lengthens the column of air in the trachea and larynx, and thus lowers the pitch of the voice. It is difficult to speak in a falsetto voice when the abdomen is thus distended.]

Sarcoma of the Maxillary Sinus.—PROF. JOSEPH S. GIBB, of Philadelphia, reports (*Journal of the American Medical Association*, February 21, 1903) a case of sarcoma of the maxillary sinus in which excision of the jaw was practised and on which he takes occasion to make a few general remarks. In this instance the rapidity of the growth was unusual. In six weeks from the time of the first manifestation of the disease the entire antrum, with a large portion of the left nasal chamber, was filled with the new-growth. Degeneration and liquefaction of the growth had taken place, and the osseous tissues were involved from pressure and absorption. After a first operation, which was the incomplete excision of the upper jaw, recurrence was noticed in seventeen days, and in four weeks' time the entire cavity became filled and the growth projected into the mouth. In a second operation the external carotid artery was then ligated and the upper jaw completely excised. The patient reacted well, and had shown no evidence of recurrence at the time of the report.

Lupus of the Epiglottis.—DR. TALBOT R. CHAMBERS, of Jersey City, N. J., reports (*The Laryngoscope*, February, 1903) a case of excision of the epiglottis for lupus in a Swedish girl, aged twenty-one years. Under chloroform vaporized by oxygen gas the excision was performed with a so-called Brandigee adenoid forceps, and adrenalin was swabbed in the wound to control the bleeding. Under the free applications of cocaine and adrenalin twelve days later a small lump of tumor was excised with the same forceps from the right epiglotto-tonsillar membrane.

A résumé of a few recorded cases in the literature accompanies the report.

OTOLOGY.

UNDER THE CHARGE OF

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Contribution to the Bacteriology of Otitis of Measles.—ALBESHEIM, of Berlin. Scheibe, through experiments by cultures and inoculations, always found pyogenic organisms in the secretions after paracentesis. Most frequent in pure cultures were streptococci, half as frequent were staphylococci albi, and somewhat rarer staphylococcus aureus. Sweigerhofer found in two cases streptococci pyogenes and staphylococcus aureus by culture and inoculation, besides, microscopically, streptococci six times, once together with staphylococci; likewise microscopically Moos got streptococci. Netter found the same; likewise in a lethal pyæmic case staphylococcus aureus and two kinds of bacilli. Zaufal cultivated—whether in pure cultures is not stated—staphylococcus aureus once. Wolff found the pneumococcus pure once, twice staphylococcus and streptococcus. Williams and Councilman obtained diphtheria bacilli in two cases of rubeola in which the throat was free.

To these cases Albesheim adds five cases. Paracentesis was done by a needle sterilized in the flame or with the galvanocautery point. Cultures were made in gelatin and agar-agar tubes. Then the contents of these tubes were poured into Petri dishes. In one case he used the water of condensation method. The gelatin plates were kept at room temperature; the agar-agar plates in the thermostat, 37° C. From the dishes existing colonies were carried over to agar-slants, and from these to another dish to get pure cultures. The biological characteristics were studied by observations on different medias and animal inoculations were made. Two smear preparations were made in each case; one stained by methylene-blue or fuchsin, the other by Gram's method.

To sum up: He found streptococcus once in pure culture; once the staphylococcus albus. Once the streptococcus was associated microscopically with a bacillus which could not be demonstrated through culture experiments. Once staphylococcus albus, together with a bacillus, were seen on a smear, but the bacteria could not be cultivated. The same picture occurred again with staphylococcus albus. The bacilli of this last case of mixed injection could be cultivated. The bacilli were small, with rounded ends, motile, and generally took the basic aniline colors well, and were intensely colored by Gram's. Flagella could not be demonstrated. The bacilli grew at room temperature and in the thermostat 37° C.; in the latter faster. On gelatin

plates it formed small white round colonies after three to twenty-four hours, causing shell-shaped liquefaction. Microscopically the superficial as well as the deep colonies appear rounded or whetstone like, have a thin border, and are finely granular. In the gelatin stab they form a thick white thread; on the surface a lardaceous, whitish coating. Here also liquefaction begins in from three to twenty-four hours. After some days the whole tube became filled with a cloudy liquid, at the bottom of which lay a compact white mass and a thin skin floating on the surface. On agar the growth is similar to that on gelatin. In grape-sugar agar gas formation failed. Bouillon was clouded in twenty-four hours, forming a cloudy sediment; after four days a delicate membrane was seen on the surface. Milk was not coagulated. The bacillus is not pathogenic for mice. Albesheim could not identify these bacteria, but they can be classified in the group of Migula.—*Archiv f. Ohrenheilkunde*, 1901, Bd. liii., S. 87–99.

Neuroses and Mastoid Operations.—MULLER (*Arch. f. Ohrenheilkunde*, Bd. liv., Heft 3 and 4) reports ten cases of chronic purulent middle-ear inflammation in which the radical operation was performed. In all of the cases a complicating neurosis was present. Two cases were complicated with epilepsy, one with chorea, one with hystero-epilepsy, four with hysteria, one with menstrual dementia, and one with multiple sclerosis. (The last case the author admits is not a neurosis.)

In one case, that complicated with chorea, apparently a permanent cure of the complication followed the operation immediately. In the other cases an improvement in the symptoms of the complicating disease took place. The improvement, however, was only temporary in a large proportion. Muller does not believe that the various neuroses were causally connected with the ear trouble, for in all of the cases the ear trouble antedated by years the nervous disease; moreover, the improvement followed immediately upon the operation when the ear trouble was far from healed. The improvement should, according to Muller, be ascribed to the mastoid operation itself, and he proposes as causal factors:

1. The narcosis and shock of the operation.
2. The loss of blood during the operation.
3. The influence of the after-treatment.

By the narcosis and shock of the operation Muller conceives that the general organism and psychical nature are upset to an extent sufficient to throw the neurosis temporarily in the background. More importance is attached to the last two factors—namely, the loss of blood and the after-treatment. Since in all the operations the dura was exposed over a greater or less extent, the effect of both the loss of blood and of the after-treatment is to alter the blood supply to the brain substance. Together with the change in the blood supply goes a change in the nourishment, and therefore function of the nervous elements.

DERMATOLOGY

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A Case of Favus of the Scrotum Co-existing with Ringworm of the Thigh, Giving Identical Trichophyton-like Cultures.—MEWBORN (*Journal of Cutaneous Diseases*, January, 1903) reports the case of a mulatto, aged twenty-two years, who had a palm-sized, red, scaly, sharply-defined patch with a papulo-vesicular border in the genito crural region, and several smaller scaly patches in the right inguinal region on the abdomen, the buttocks, and in both axillæ. At the same time, on the anterior surface of the scrotum there was a chain of typical favus cups presenting the usual features. Microscopic examination of the scrapings from the scaly patches showed a fungus presenting the features of the trichophyton, while the favus cups presented an entirely different picture, corresponding to the types of fungus found in favus of the scalp. Cultures were made from the patches and from the favus cups on glucose agar, and kept at the ordinary room temperature. At the end of a week the growth obtained from the cups was indistinguishable from that made from the ringworm patch. Attempts to inoculate the favus cultures on the author's arm and on mice were unsuccessful, but inoculations with the trichophyton cultures succeeded upon a rabbit, favus cups appearing at the end of a week. The author concludes from this case that the same trichophyton, on the same patient, but in different parts of the body, produced two clinically distinct diseases—favus and ringworm.

Dermatitis Coccidioides.—MONTGOMERY, RYFKOGEL, and MORROW (*Journal of Cutaneous Diseases*, January, 1903) add a new case of this rare and extremely interesting affection to the small number previously reported. The patient, a man, aged fifty-four years, a native of Switzerland, first came under Dr. Montgomery's observation in January, 1901. He was neither tuberculous nor syphilitic. The trouble for which he sought advice had begun seven years before as an enlargement of the left hand and forearm. These continued to enlarge, and a year later the left leg and ankle began to enlarge. Four years later an eruption appeared upon the chest, remains of which were still present, and in 1900 an eruption had appeared upon the left forearm and hand. There was hypertrophy of the skin and subcutaneous tissue of the left forearm, hand, both legs, and left foot. There was no apparent enlargement of the bones. Over the chest and abdomen there was pigmentation occurring as brown, pea-sized spots, the remains of a previous

papular eruption. On the left forearm and back of the left hand there was an eruption of discrete papules, pustules, and nodules, many of the pustules being covered with crusts. Upon the neck there was a pustular folliculitis forming a boggy mass, and the right ear presented a condition resembling an acute eczema. Upon the left leg there was a superficial elephantiasis with papillary overgrowth.

The patient had been treated for syphilis at various times without benefit, and had taken iodide of potassium in increasing doses without producing any change in the disease. For two months he was treated with the X-rays with decided benefit, the pustules drying up and the nodules becoming flatter; but this treatment had to be interrupted because of the progress of the internal infection. Death occurred one year after the correct diagnosis had been made.

At the autopsy the suprarenal capsules were found to be much enlarged, the normal tissue being replaced by a friable, fairly dense, yellowish-white tissue. The left lung throughout its entire extent and the upper lobe of the right lung contained numerous bodies resembling miliary tubercles. Microscopically the tubercle-like bodies and the suprarenal capsules were found to consist of granulomatous tissue containing numerous giant cells and capsulated bodies, many of the latter being included in the giant-cells. The organism found in the disease presented a double cycle of growth, one in the tissues, the other on culture media, the two cycles having no features in common. In the tissues it occurred as a sphere 3.5 to 5 microns in diameter, surrounded by a clear capsule, the outer wall covered with spines which could only be seen in the fresh specimen. The smaller capsules had clear or granular contents, the larger ones were filled with endogenous spores. Outside of the body the growth was that of a mould fungus. When a sufficient quantity of the culture was employed intraperitoneal inoculations in the guinea-pig were invariably fatal.

The Treatment of Lupus Erythematosus.—HOLLANDER (*Berliner klinische Wochenschrift*, 1902, No. 30) has employed the following method of treatment with very satisfactory results in the severest and most unfavorable cases of erythematous lupus: Large doses of quinine are administered internally, and at the same time the diseased areas are treated locally by applications of tincture of iodine. After having ascertained that the patient has no idiosyncrasy in regard to this drug, a half-gramme of the sulphate or hydrochlorate of quinine is given three times a day, and five to ten minutes after each dose the affected parts are thoroughly painted with iodine. This is continued for five or six days; then the treatment is suspended for an equal period of time, until the crust produced by the iodine has fallen off. If the reaction is slight the dose of the quinine is increased. The result of this treatment is either a scar-like atrophy or a complete return of the skin to the normal, the latter occurring in the recent cases. In the majority of cases about 60 grammes of quinine are necessary to complete the cure.

Alopecia Areata of the Moustache of Dental Origin.—MILIAN (*Annales de Dermatologie et de Syphiligraphie*, 1902, No. 11), at a séance of the Société Francaise de Dermatologie et de Syphiligraphie, reported the following

interesting case of alopecia areata: A man, aged thirty-five years, who had suffered much from carious teeth, of which he had a great number, presented a patch of alopecia areata in the mustache over the right lateral superior incisor. This tooth, after a severe neuralgia of both jaws, had remained very sensitive, and the patch of alopecia had developed over it at the same time that vesicles, identical in appearance with those of herpes, had appeared on the corresponding part of the gum. The hairs about the borders of the patch were easily extracted, and presented the usual appearances observed in this disease. The skin was thinned and presented a marked anæsthesia. There were no other patches of alopecia. The patient was directed to have the mouth cleansed and the teeth looked after by a dentist, and was given quinine internally in moderate doses. Shortly after the jaws had been put in good condition, the sensitive incisor having been extracted, the patch of alopecia ceased to extend. Later, the neuralgia ceased, the sensibility of the skin returned, and, at the end of about four months, the plaque was completely covered with hair.

Mycosis Fungoides and Its Treatment by the X-rays.—JAMIESON (*British Journal of Dermatology*, January, 1903) reports two new cases of this comparatively infrequent affection, in one of which quite remarkable results followed the prolonged use of the X-rays. This case began with the usual eczema-like patches, which were followed in time by tumors which ulcerated. Soon after coming under the author's care treatment with the X-rays was begun, the exposures lasting from three to five minutes, with a soft tube at a distance of four inches. This treatment resulted in a steady and continuous shrinkage of the tumors, although new lesions appeared in the parts not exposed to the rays. After sixty exposures, on as many different days, all the tumors had disappeared. Reaction sufficiently marked to require suspension of the treatment was at no time manifest. Not only did the tumors disappear, but the thickened patches were also removed, and with them the itching.

Acute Symmetrical Erythematous Keratodermia Caused by the Administration of Arsenic.—WHITE (*British Journal of Dermatology*, January, 1903) reports the following case: A boy, aged thirteen years, suffering from a severe chorea, was given 4 minims of liquor arsenicalis every four hours, and later the dose was increased until he was taking 10 minims every four hours. At the end of ten days the physiological effects of the drug, such as conjunctivitis, coryza, white-coated tongue, became manifest. The drug was now stopped. Erythematous symmetrical patches then appeared over all the metacarpophalangeal and phalangeal joints, and the thenar and hypothenar eminences appeared as lemon-colored islands surrounded by erythematous rings. Erythematous zones appeared upon the flexor aspects of the wrists, upon the extensor surfaces of the elbows, and upon all points subjected to pressure, as the spines of the scapulæ, the buttocks, and the great trochanters. The bony prominences of the legs and feet were similarly affected, and the soles presented appearances similar to those of the hands. All these zones were symmetrically circular, rose-pink in color, fading away toward the margins, which were well-defined; they were tender to the touch,

and the skin was considerably thickened. Over the entire body was a scarlet rash resembling that of mild scarlatina. Two days later tenderness had disappeared, the affected zones became darker and began to desquamate. The mucous membrane of the lips also began to desquamate, and the alæ nasi were thickened and irritable. Two or three weeks later the patient was discharged, cured of his chorea, and without any trace of arsenical pigmentation. Altogether the patient had taken 3.5 grains of arsenious anhydride. As the author has seen a number of similar cases in children taking large doses of arsenic, he is of the opinion that they are commoner than is generally supposed.

Erythema Scarlatiniforme Desquamativum Recidivans.—KRAMSZTYK (*Dermatologische Zeitschrift*, Band ix., Heft 3) reports three cases of this interesting affection, in the first two of which nine attacks occurred, and in the other two, two and three attacks respectively. In first attacks the diagnosis between this disease and scarlatina may be difficult. The absence of the pharyngeal redness and the strawberry tongue characteristic of the latter are of great value in the differential diagnosis, although these are occasionally seen in the former affection. Even such complications as inflammation of the ears and nephritis may occur, so that the only certain diagnostic feature is the recurrence of the eruption. The author believes that the disease is not a local affection of the skin, but a general infection to be classed with the other infectious exanthemata; it is not an erythema scarlatiniforme, but a "pseudoscarlatina recurrens."

Syphilitic Erythema Nodosum.—MARCUSE (*Archiv für Dermatologie und Syphilis*, Band lxiii., Heft 1) reports three cases presenting an eruption resembling, more or less closely, ordinary erythema nodosum, in which symptoms of secondary syphilis were also present. In all three cases, besides many lesions which resembled opened furuncles, there were softened nodes like gummata, and solid ones resembling the lesions of erythema nodosum. Histological examination of an excised node revealed a phlebitis undergoing transformation into a granulation tumor presenting the characteristics of a gumma. The author's conclusions, from a study of his own cases and those reported by other observers, are as follows: In rare and relatively severe cases of syphilis an erythema nodosum-like eruption appears in those regions of the body for which erythema nodosum shows a preference, which, as a rule, should be regarded as a specific form of exanthem, and is best designated as a "nodose syphilide," as is done by the French. This nodose syphilide usually appears in the first year after infection and is often associated with other secondary skin manifestations. Its course is varied; in some cases it disappears without leaving any trace; in others softening and ulceration occur. On clinical grounds, as well as from pathologico-anatomical investigation, it is probable that these lesions have their origin in the subcutaneous veins. There are great analogies, clinically as well as anatomically, between this eruption and certain nodose "tuberculides" which have their origin in the veins. Upon clinical grounds it is probable that this form of eruption must sometimes be regarded as belonging to the secondary period, sometimes to the tertiary, and occasionally as intermediate between the two.

PATHOLOGY AND BACTERIOLOGY.

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On Changes in the Bacteriolytic Power of the Blood after Typhoid Vaccination, and On the Protective Value of Antityphoid Vaccination.—WRIGHT (*The Lancet*, September 14, 1901, 715; *Ibid.*, September 6, 1902) shows that injections of an amount of vaccine sufficient to cause a marked reaction are followed by a decreased bacteriolytic power in the patient's blood against the typhoid bacilli, as can be shown *in vitro*, and as unfortunately has been shown practically by the greater susceptibility of such recently vaccinated patients to typhoid infection. This period of diminished resistance is followed by a marked increase of bacteriolytic power over the normal. To obviate such difficulties the author advises smaller doses at first, which are found to increase at once the patient's bacteriolytic power, and which may then be followed by larger doses. In his second paper Wright discusses the tabulated results of the thousands of soldiers, who, in the past few years, have been vaccinated against typhoid before going to regions of infection. He finds that the mortality and also the liability to infection of vaccinated over unvaccinated men is reduced to from two to twenty-eight fold.—F. P. G.

The Influence of Mode of Introduction on the Preventive and Curative Action of Tetanus Antitoxin.—DESCOSS and BARTHELEMY (*Jour. de Physiologie et Pathologie Générale*, 1902, vol. iv., No. 5), in experimenting on rabbits with a strong tetanus antitoxin, find the preventive dose given twenty-four hours before injection of tetanus toxin is equally efficacious, whether injected intraperitoneally, intracranially, intradurally, subcutaneously, or intravenously. When the antitoxin is given twenty-four hours after the toxins, that is, during the beginning period of contractures, the intraperitoneal injection is worthless, and the intravenous injections are by far the best. In the period of full tetanus, forty-eight hours after the toxins, the subdural method alone will save. The authors suggest from these results the use of the intravenous injections in cases of tetanus treated with antitoxin during the incubation period.—F. P. G.

Preliminary Report of the Appearance in the Philippine Islands of a Disease Clinically Resembling Glanders.—R. P. STRONG (Bureau of Government Laboratories, Manila, 1902) discusses the findings in a malady

affecting horses, and more rarely cattle, in Manila, which was at first taken for farcy, the cutaneous form of glanders. The disease starts as a slight abrasion in the skin and spreads along the lymphatics, forming subsequently abscesses in the glands. It may secondarily reach the nares, but never occurs there primarily. It is not usually fatal. On microscopic examination the etiological factor is found to be a blastomyces, which is grown with difficulty on artificial media and will reproduce the characteristic lesion in monkeys. The causative organism is not to be mistaken for the mould fungus causing "bursattee" in India, but is closely allied in all probability to the "saccharomyces farcinomosus" described by Tokishiga as the cause of lymphangitis in epizootica in Japan. The treatment recommended is the cleansing of the skin with some antiseptic solution and opening of the tumors, followed by curetting and irrigation.—F. P. G.

The Serumtherapy of Typhoid Fever.—CHANTEMESSE (*La Presse Médicale*, 1902, vol. ii., No. 103, p. 1227) presents a carefully tabulated account of the percentage of mortality in cases of typhoid fever in Paris during twenty months, which have received the ordinary medical treatment, including cold baths, in comparison with the cases treated by antityphoid serum and cold baths. In the General Paris Hospital the number of cases under ordinary treatment was 1192 with 286 deaths, that is, a mortality of 19.3 per cent. In the Bastion hospital where the serum treatment was adopted the cases numbered 179, with a mortality of 3.7 per cent. In the Saint Mandier Hospital of 151 cases treated with serum the mortality was under 6 per cent. The disease has been of an unusual virulence during this period. The fatal cases at the Bastion were attributable in most cases to intestinal perforation. Experimental results on guinea-pigs show that the serum has the power of preventing and curing fatal doses of the living typhoid organism or of the typhoid toxines.—F. P. G.

A Study of an Hæmolytic Complement Found in the Serum of the Rabbit.—SWEET (*Univ. of Penna. Med. Bulletin*, December, 1902, vol. xv.), as the result of a most painstaking research, comes to the following conclusion in regard to the complement in rabbit's serum necessary to complete the hæmolysis of bovine erythrocytes which have been sensibilized with artificially produced rabbit's immune body:

1. The complement content of the serum may be increased by the injection of certain chemiotactic substances such as aleuronat and oil of turpentine.

2. The complement is not secreted by leucocytes, but exists in the circulating plasma.

3. It does not occur in the normal aqueous fluid of the anterior chamber of the eye, but is present in the transudate which fills the chamber after the normal aqueous fluid has been withdrawn. This newly-formed fluid contains no leucocytes, and the complement contained in it is due to abnormal pressure osmosis of the ciliary vessels owing to decreased intraocular pressure.

4. An artificially prepared plasma contains complement.

5. The artificially increased natural resistance in the peritoneum of animals caused by previous injections of such fluids as bouillon is probably due to similar changed osmotic conditions which allow the passage of complement from the circulating blood.—F. P. G.

The Relationship Between Human and Bovine Tuberculosis.—J. G. ADAMI (*Manchester Medical Chronicle*, March, 1902) has confessed himself to be of an open mind on many of the points involved in this discussion, which was brought to a height by Koch's rather startling paper before the London Congress of Tuberculosis in 1901; but after a full and judicious review of the work of others, and from his own experience, he ventures pretty definite conclusions on the more important points in question.

Bovine tuberculosis can be and usually is transmitted from cattle to cattle by inhalation or contamination of the various discharges. Human tuberculosis is likewise transmissible to cattle, but is not markedly virulent except as a mixed infection. Certain breeds of swine seem to show more marked susceptibility than others to this form of infection.

Human tuberculosis is usually transmitted from man to man, and the organisms of human tuberculosis vary somewhat culturally and pathogenically from the bovine variety, but not to the point that we should be justified in regarding the two as different species.

Bovine tuberculosis may be transmitted from cattle to man either through wounds or through the alimentary canal by food, the latter form of infection being almost entirely limited to children. Milk infections probably take place only in cases of advanced disease in animals in which large numbers of bacilli are present. Animals showing either physical signs of tuberculosis or reaction to tuberculin should be killed.—F. P. G.

Agglutination in Mixed Infections, and Their Means of Diagnosis.—CASTELLANI (*Zeitschrift für Hygiene*, 1902, Band xl. p. 1) has experimentally shown the coexistence of several specific agglutination properties in the blood of mixed infection, and has indicated a method which may prove of great value in the diagnosis of infections due to more than one microorganism. The work has been done principally on rabbits, and the organisms chiefly used were the B. typhosus, B. coli, and B. pseudodysenteriæ (Kruse). He finds in experimental mixed infections brought about by the inoculaton of subminimal lethal doses of living bouillon cultures that the blood of the animal acquires agglutinative properties for each of the organisms—properties equal in onset, intensity, and duration to such properties as existing in an infection caused by any single organism. When a second infection follows the first after a lapse of time, the agglutinative power for the second organism follows the regular course, and the agglutination for the first organism is in nowise affected. In mixed infections in man the several specific agglutination properties are found to be present. This would readily serve for the diagnosis of mixed infections if it were not for the fact that normal agglutinative properties may exist in the blood for organisms other than that causing the infection. To obviate this the author has devised the following scheme: He finds that when 2 or 3 c.c. of serum of an animal infected with a single organism are placed for twenty-four

hours with a considerable mass of the causative organism, these will settle to the bottom, and the serum—before this treatment highly agglutinative—will lose not only all agglutinative power for the causative organism, but also its natural agglutinative properties for other organisms. With the serum, however, of an animal infected or immunized with two or more organisms (A and B), saturation with A, for example, will remove all the agglutinative properties for A, but in nowise affect those of B.—F. P. G.

Presence of the Bacillus of Eberth in the Blood of Typhoid Fever Patients.—M. BUSQUET (*La Presse Médicale*, 1902, No. 50, p. 593) records forty-three cases of typhoid fever, in all of which he was able to isolate the typhoid bacillus from the blood during life. In thirty-three examinations the result was positive in the first culture, seven times in the second culture, twice in the third culture, and once the organism was not obtained until the fourth trial. The bacillus was obtained twenty-two times between the fourth and seventh days, sixteen times during the second week, and five times during the third week. It was, moreover, isolated from the blood in eight cases before the Widal reaction was positive. In only twenty-nine of the forty-three cases was the typhoid bacillus found alone, for in the other cases organisms such as the pneumococcus, streptococcus pyogenes, and staphylococcus pyogenes aureus were likewise present. Most of the cases with mixed infections were either clinically atypical or exceedingly severe. The technique was similar to that described by Cole, etc., except that only 1 to 5 c.c. of blood was used, and this amount was distributed among twenty to thirty flasks, containing 250 c.c. of bouillon each.

Busquet draws particular attention to the clinical value of this method of diagnosis in atypical cases of typhoid fevers, and also dwells on its use as a means of early diagnosis. He believes it especially helpful in cases when the Widal reaction is delayed. Such methods are, of course, not available for private practice, but in large, well-equipped hospitals the author thinks their adoption would be of great advantage.—W. T. L.

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